

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF TEXAS
DALLAS DIVISION**

UBIQUITOUS CONNECTIVITY, LP,

Plaintiff,

v.

TXU ENERGY RETAIL COMPANY LLC,

Defendant.

CIVIL ACTION NO. _____

JURY TRIAL DEMANDED

ORIGINAL COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff UBIQUITOUS CONNECTIVITY, LP (hereinafter, “Plaintiff” or “Ubiquitous”), by and through its undersigned counsel, files this Original Complaint for Patent Infringement against Defendant TXU ENERGY RETAIL COMPANY, LLC (hereinafter, “Defendant” or “TXU”) as follows:

NATURE OF THE ACTION

1. This is a patent infringement action to stop Defendant’s infringement of Plaintiff’s United States Patent Nos. 8,064,935 (hereinafter, the “’935 Patent”) and 9,602,655 (hereinafter, the “’655 Patent”) (collectively, the “Patents-in-Suit”), copies of which are attached hereto as Exhibit A and Exhibit B, respectively. Plaintiff is the owner of the Patents-in-Suit. Plaintiff seeks injunctive relief and monetary damages.

PARTIES

2. Ubiquitous is a limited liability partnership organized and existing under the laws of the State of Texas since February 14, 2012 and maintains its principal place of business at 2436 Tisbury Way, Little Elm, Texas, 75068 (Denton County).

3. Based upon public information, Defendant TXU is a corporation duly organized and existing under the laws of the state of Texas since June 29, 2007.

4. Based upon public information, Defendant TXU has its principal place of business located at 1601 Bryan Street, Dallas, Texas 75201-3430 (Dallas County).

5. Based upon public information, Defendant TXU may be served through its registered agent, C T Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201.

6. Based upon public information, Defendant ships, distributes, makes, uses, offers for sale, sells, and/or advertises its products and/or services under the iThermostat branded system.

JURISDICTION AND VENUE

7. This action arises under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq.*, including 35 U.S.C. §§ 271, 281, 283, 284, and 285. This Court has subject matter jurisdiction over this case for patent infringement under 28 U.S.C. §§ 1331 and 1338(a).

8. The Court has personal jurisdiction over Defendant because: Defendant has minimum contacts within the State of Texas and in the Northern District of Texas; Defendant has purposefully availed itself of the privileges of conducting business in the State of Texas and in the Northern District of Texas; TXU has sought protection and benefit from the laws of the State of Texas and is incorporated there; Defendant regularly conducts business within the State of Texas and within the Northern District of Texas, and Plaintiff's causes of action arise directly from Defendant's business contacts and other activities in the State of Texas and in the Northern District of Texas.

9. More specifically, TXU, directly and/or through its intermediaries, ships, distributes, makes, uses, imports, offers for sale, sells, and/or advertises its products and affiliated services in the United States, the State of Texas, and the Northern District of Texas. Based upon public information, Defendant has committed patent infringement in the State of Texas and in the

Northern District of Texas. Defendant solicits customers in the State of Texas and in the Northern District of Texas. Defendant has many paying customers who are residents of the State of Texas and the Northern District of Texas and who use Defendant's products in the State of Texas and in the Northern District of Texas.

10. Venue is proper pursuant to 28 U.S.C. §1400(b) because Defendant resides in the Northern District of Texas because of its formation under the laws of Texas.

11. Venue is proper pursuant to 28 U.S.C. § 1391(b) and (c) because Defendant resides in the Northern District of Texas because of its formation under the laws of Texas, which subjects it to the personal jurisdiction of this Court.

BACKGROUND INFORMATION

12. The Patents-in-Suit were duly and legally issued by the United States Patent and Trademark Office (hereinafter, "USPTO") after full and fair examinations.

13. The Parents-in-Suit trace their priority date back to USPTO Application No. 11/163,372 (the "'372 Application") which was filed on October 17, 2005 and issued after full and fair examination as U.S. Patent No. 7,257,397. See Ex. A at A-1 and Ex. B at B-1.

14. The '372 Application is itself a divisional of USPTO Application No. 11/160,006 (the "'006 Application") which was filed on June 6, 2005 and issue as and issued after full and fair examination as U.S. Patent No. 6,990,335. See Ex. A at A-1 and Ex. B at B-1.

15. The '006 Application traces its priority to USPTO Provisional Application No. 60/522,887 (the "'887 Application") which was filed on November 18, 2004. See Ex. A at A-1 and Ex. B at B-1.

16. Plaintiff is the owner of the Patents-in-Suit, and possesses all right, title and interest in the Patents-in-Suit including the right to enforce the Patents-in-Suit, the right to license the

Patents-in-Suit, and the right to sue Defendant for infringement and recover past damages. See Exhibit C and D.

17. Based upon public information, Defendant owns, operates, advertises, and/or controls the website www.txu.com, through which Defendant advertises, sells, offers to sell, provides and/or educates customers about its products and services, including but not limited to Defendant's TXU iThermostat branded system (collectively, the "Accused Products and Services"). Evidence obtained from TXU's website (and others) regarding these products is provided in Exhibits E through H.

18. TXU offers its customers the ability to download the TXU iThermostat app, which allows users to control their iThermostat device remotely from a mobile device such as but not limited to an iPhone, iPad, or Android device. See Exhibit E, at p. 3 (indicating the app is available for download on the Apple App Store and for Android at Google Play).

19. According to the description of the TXU iThermostat app on TXU's webpage:



Control your comfort.

Set your iThermostat to the temperature you like and forget it. When you change your mind – or the weather changes it for you – simply use the iThermostat app to adjust the temperature. Be comfortable at home, and save energy and money while you're away.



Make a smarter home.

Set a schedule conveniently from your smartphone, online or the thermostat. You can toggle between heat and cold and set temperature holds. Program it to know when you're close to home so you can walk into comfort. Plus, your iThermostat tracks your usage and can help you use less and save more.



Access anytime, anywhere.

Adjust your thermostat whenever, wherever with the iThermostat app. You can also control it using simple voice commands with an Amazon Alexa-enabled device. Just open your Alexa app and search for the TXU iThermostat skill.



Leave a positive impact.

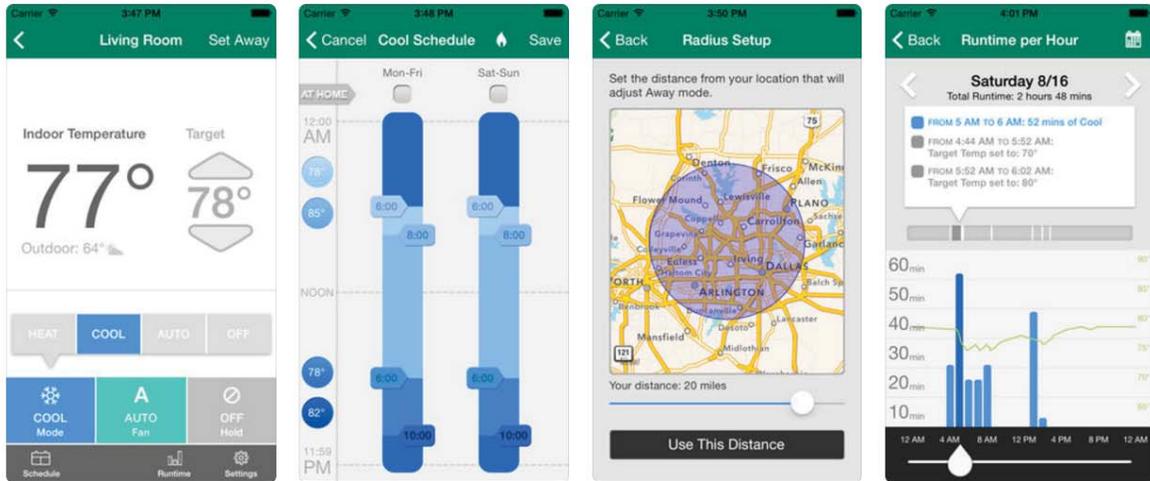
As an iThermostat customer, not only can you save money, but you can also help the environment by participating in the TXU Conservation Program.*

Figure 1

See Exhibit E.

20. According to the description of the TXU iThermostat app on the Applications page for Apple iPhones, the provider for the TXU iThermostat app is TXU Energy Retail Company LLC. See Exhibit F.

21. According to the description of the TXU iThermostat app on the Applications page for Apple iPhones:



Description

The TXU iThermostat™ app allows you to control your thermostat from your iPhone® or iPad®. No need to have to go to your actual thermostat again to set your schedule or change the temperature.

Now with location-based controls, you can program settings to start and stop your heating and cooling when you are close to your home or business based on your smartphone's GPS location. The TXU iThermostat™ app allows you to remotely adjust your thermostat's settings, or quickly put your entire home or business into energy saving "Away" mode with the tap of a button.

Figure 2

See Exhibit F.

22. Upon information and belief, the iThermostat app allows users (1) to change the settings of their iThermostat in near real-time (typically within one minute) from their mobile devices; (2) to set heating and cooling schedules for the iThermostat from their mobile devices; (3) provides users with usage data related to the iThermostat system; and (4) to set the distance from their iThermostat that will adjust the "Away mode" of the iThermostat system. See Exhibit F.

23. Upon information and belief, at least certain TXU iThermostat systems provided to customers also include a feature known as Radius™. This Radius™ uses GPS location serves on a user's mobile device "to determine when you've left your location and turns on Away for your thermostat(s)." See Exhibit F and G.

24. Upon information and belief, the Brighten® iThermostat device may also receive current room temperature readings from a thermostat and send control instructions, *i.e.* increasing or decreasing room temperature, to the user's HVAC system. See Exhibit H, at p. 3 and 4.

25. TXU provides guidance to its prospective customers through documents that provide information to educate users about the benefits of iThermostat system and how to choose the right system for a customer's particular requirements. See Exhibits E-H.

COUNT I
INFRINGEMENT OF U.S. PATENT NO. 8,064,935

26. Plaintiff re-alleges and incorporates by reference each of paragraphs above.

27. The '935 Patent issued from USPTO Application No. 11/686,993 which was filed on March 16, 2007 and is a divisional application of the '372 Application. See Ex. A at A-1.

28. The '935 Patent was duly issued by the USPTO on November 22, 2011. See Ex. A at A-1.

29. Plaintiff is informed and believes that Defendant has infringed and continues to infringe claims of the '935 Patent, either literally or under the doctrine of equivalents, through the manufacture and sale of infringing system under the iThermostat brand, and other product lines. Based upon public information, Defendant has infringed and continues to infringe one or more claims of the '935 Patent, including Claim 19, because it ships distributes, makes, uses, imports, offers for sale, sells, and/or advertises devices, including at least the Accused Products and Services, that form a wirelessly controllable smart thermostat system that incorporates a base unit (Brighten® iThermostat) interfaced with an environmental device (thermostat). See, supra, Paragraphs 17-24, and Figures 1 and 2.

30. Based upon public information, Defendant has intentionally induced and continues to induce infringement of one or more claims of the '935 Patent in this district and elsewhere in

the United States, by its intentional acts which have successfully, among other things, encouraged, instructed, enabled, and otherwise caused Defendant's customers to use the Accused Products and Services in an infringing manner. To the extent that Defendant is not the only direct infringer of the '935 Patent, customers that have purchased and/or used the Accused Products, including the iThermostat (see Exs. E-H), constitute direct infringers.

31. Despite knowledge of the '935 Patent as early as July 31, 2017, based upon public information, Defendant continues to encourage, instruct, enable, and otherwise cause its customers to use its products and services, in a manner which infringes the '935 Patent. See Exs. E-H; I and J (Original Complaint and Summons). Based upon public information, the provision of and sale of the Accused Products and Services is a source of revenue and a business focus of Defendant. See Exs. E-H.

32. Based upon public information, Defendant specifically intends its customers to use its products and services in such a way that infringes the '935 Patent by, at a minimum, providing and supporting the Accused Products and Services and instructing its customers on how to use them in an infringing manner, at least through information available on Defendant's website including information brochures, promotional material, and contact information. See e.g. Exs. E-H.

33. Specifically, Defendant offers design services to select, deploy and integrate its products to assist its customers in installing and utilizing the infringing remote control system. See e.g. Exs. E-H. Based upon public information, Defendant knew that its actions, including but not limited to any of the aforementioned products and services, would induce, have induced, and will continue to induce infringement by its customers of the '935 Patent by continuing to sell,

support, and instruct its customers on using the Accused Products and Services. See e.g. Exs. E-H.

34. Upon information and belief, Defendant also contributes to the infringement of the ‘935 Patent by offering for sale and/or selling components that constitute a material part of the invention claims in the ‘935 Patent.

35. For example, Defendant has offered for sale and/or sold numerous thermostat systems and iThermostat devices that infringe the ‘935 Patent, as discussed above.

36. Upon information and belief, TXU’s iThermostat system have no substantial, non-infringing uses. For example, the TXU website states

*TXU iThermostat is available in eligible services areas for single-family homes with compatible central HVAC and high-speed Internet services. Requires 2-year agreement on TXU Conservation Program, which may include brief on/off cycling (10-15 minutes) of customer's air conditioner or modification to thermostat setpoints no more than four degrees higher than programmed settings (up to 1-4 hours) via remote signal from TXU Energy during periods of peak energy usage from May-September; customer may opt out of individual demand response events. Applicable monthly fee appears on your TXU Energy bill. See terms and conditions for details.

Figure 3

See Exhibit E, at p. 4. In essence, TXU requires customers have Internet access and participation in TXU Conservation Program.

37. As a result, these iThermostat systems can only be used in a manner that infringes the ‘935 Patent, and on information and belief, have been used by Defendant’s customers in a manner that directly infringes one or more claims of the ‘935 Patent.

38. Defendant’s aforesaid activities have been without authority and/or license from Plaintiff.

39. Plaintiff is entitled to recover from Defendant the damages sustained by Plaintiff as a result of Defendant’s wrongful acts in an amount subject to proof at trial, which, by law, cannot

be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

40. Defendant's infringement of Plaintiff's rights under the '935 Patent will continue to damage Plaintiff, causing irreparable harm to Plaintiff for which there is no adequate remedy at law, unless enjoined by this Court.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 9,602,655

41. Plaintiff re-alleges and incorporates by reference each of paragraphs above.

42. The '655 Patent issued from USPTO Application No. 13/271,203 which was filed on October 11, 2011 and is a continuation of the application that resulted in the issuance of the '935 Patent. See Ex. B at B-1.

43. The '655 Patent was duly issued by the USPTO on March 21, 2017. See Ex. B at B-1.

44. Plaintiff is informed and believes that Defendant has infringed and continues to infringe claims of the '655 Patent, either literally or under the doctrine of equivalents, through the manufacture and sale of infringing products under the iThermostat brand, and other product lines. Based upon public information, Defendant has infringed and continues to infringe one or more claims of the '655 Patent, including at least Claim 1, because it ships distributes, makes, uses, imports, offers for sale, sells, and/or advertises devices, including at least the Accused Products and Services, that form a remotely controllable smart thermostat system. See, supra, Paragraphs 17-24, and Figures 1 and 2.

45. Based upon public information, Defendant has intentionally induced and continues to induce infringement of one or more claims of the '655 Patent in this district and elsewhere in the United States, by its intentional acts which have successfully, among other things, encouraged,

instructed, enabled, and otherwise caused Defendant's customers to use the Accused Products and Services in an infringing manner. To the extent that Defendant is not the only direct infringer of the '655 Patent, customers that have purchased and/or used the Accused Products, iThermostat (see Exs. E-H), constitute direct infringers.

46. Despite knowledge of the '655 Patent as early as July 31, 2017, based upon public information, Defendant continues to encourage, instruct, enable, and otherwise cause its customers to use its products and services, in a manner which infringes the '655 Patent. See Exs. E-H; I and J (Original Complaint and Summons). Based upon public information, the provision of and sale of the Accused Products and Services is a source of revenue and a business focus of Defendant. See Exs. E-H.

47. Based upon public information, Defendant specifically intends its customers to use its products and services in such a way that infringes the '655 Patent by, at a minimum, providing and supporting the Accused Products and Services and instructing its customers on how to use them in an infringing manner, at least through information available on Defendant's website including information brochures, promotional material, and contact information. See e.g. Exs. E-H..

48. Specifically, Defendant offers design services to select, deploy and integrate its products to assist its customers in installing and utilizing the infringing remote control system. See e.g. Exs. E-H. Based upon public information, Defendant knew that its actions, including but not limited to any of the aforementioned products and services, would induce, have induced, and will continue to induce infringement by its customers of the '655 Patent by continuing to sell, support, and instruct its customers on using the Accused Products and Services. See e.g. Exs. E-H.

49. Upon information and belief, Defendant also contributes to the infringement of the ‘655 Patent by offering for sale and/or selling components that constitute a material part of the invention claims in the ‘655 Patent.

50. For example, Defendant has offered for sale and/or sold numerous thermostat systems and iThermostat devices that infringe the ‘655 Patent, as discussed above.

51. Upon information and belief, these thermostat systems and iThermostat devices have no substantial, non-infringing uses. For example, the TXU website states

*TXU iThermostat is available in eligible services areas for single-family homes with compatible central HVAC and high-speed Internet services. Requires 2-year agreement on TXU Conservation Program, which may include brief on/off cycling (10-15 minutes) of customer's air conditioner or modification to thermostat setpoints no more than four degrees higher than programmed settings (up to 1-4 hours) via remote signal from TXU Energy during periods of peak energy usage from May-September; customer may opt out of individual demand response events. Applicable monthly fee appears on your TXU Energy bill. See terms and conditions for details.

Figure 3

See Exhibit E, at p. 4. In essence, TXU requires customers have Internet access and participation in TXU Conservation Program.

52. As a result, these iThermostats can only be used in a manner that infringes the ‘655 Patent, and on information and belief, have been used by Defendant’s customers in a manner that directly infringes one or more claims of the ‘655 Patent.

53. Defendant’s aforesaid activities have been without authority and/or license from Plaintiff.

54. Plaintiff is entitled to recover from Defendant the damages sustained by Plaintiff as a result of Defendant’s wrongful acts in an amount subject to proof at trial, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

55. Defendant's infringement of Plaintiff's rights under the '655 Patent will continue to damage Plaintiff, causing irreparable harm to Plaintiff for which there is no adequate remedy at law, unless enjoined by this Court.

JURY DEMAND

56. Plaintiff demands a trial by jury on all issues.

PRAYER FOR RELIEF

57. Plaintiff respectfully requests the following relief:

- A. An adjudication that one or more claims of the Patents-in-Suit has been infringed, either literally and/or under the doctrine of equivalents, by the Defendant;
- B. An adjudication that Defendant has induced infringement of one or more claims of the Patents-in-Suit based upon post-filing date knowledge of the Patents-in-Suit;
- C. An award of damages to be paid by Defendant adequate to compensate Plaintiff for Defendant's past infringement and any continuing or future infringement up until the date such judgment is entered, including interest, costs, and disbursements as justified under 35 U.S.C. § 284 and, if necessary to adequately compensate Plaintiff for Defendant's infringement, an accounting of all infringing sales including, but not limited to, those sales not presented at trial;
- D. A grant of permanent injunction pursuant to 35 U.S.C. § 283, enjoining the Defendant and its respective officers, agents, servants, employees, and attorneys, and those persons in active concert or participation with them who receive actual notice of the order by personal service or otherwise, from further

acts of infringement with respect to any one or more of the claims of the Patents-in-Suit;

- E. That this Court declare this to be an exceptional case and award Plaintiff its reasonable attorneys' fees and costs in accordance with 35 U.S.C. § 285; and,
- F. Any further relief that this Court deems just and proper.

Dated: August 4, 2018

Respectfully submitted,

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* admission *Pro Hac Vice* to be applied for

EXHIBIT A

(12) **United States Patent**
Shamoon et al.

(10) **Patent No.:** **US 8,064,935 B2**
(45) **Date of Patent:** **Nov. 22, 2011**

(54) **UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR REMOTE LOCATIONS**

(75) Inventors: **Charles G. Shamoon**, Little Elm, TX (US); **Deborah H. Shamoon**, Little Elm, TX (US); **Franklin Eugene Neal**, Ashland, KY (US); **Michael D. Fehnel**, Fuquay-Varina, NC (US)

(73) Assignees: **Charles G. Shamoon**, Little Elm, TX (US); **Deborah H. Shamoon**, Little Elm, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 911 days.

(21) Appl. No.: **11/686,993**

(22) Filed: **Mar. 16, 2007**

(65) **Prior Publication Data**

US 2007/0167179 A1 Jul. 19, 2007

Related U.S. Application Data

(62) Division of application No. 11/163,372, filed on Oct. 17, 2005, now Pat. No. 7,257,397, which is a division of application No. 11/160,006, filed on Jun. 6, 2005, now Pat. No. 6,990,335.

(60) Provisional application No. 60/522,887, filed on Nov. 18, 2004.

(51) **Int. Cl.**
H04W 4/00 (2009.01)

(52) **U.S. Cl.** **455/466**; 709/219; 709/208; 709/229; 709/243; 709/244; 455/456.6; 455/92; 455/352; 455/418; 455/414; 455/420; 455/123; 455/151.1; 455/230

(58) **Field of Classification Search** 709/219, 709/208, 229, 243, 244; 455/456.6, 92, 352, 455/418, 414, 420, 123, 151.1, 230

See application file for complete search history.

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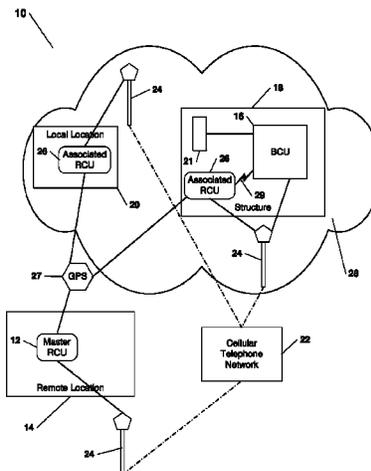
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Primary Examiner — Kamran Afshar
Assistant Examiner — Edward Zhang
(74) *Attorney, Agent, or Firm* — Hershkovitz & Associates, LLC; Abraham Hershkovitz

(57) **ABSTRACT**

A thermostat control system for monitoring and controlling environmental characteristics of a building includes a base station unit and a remote access unit continuously interfacing through instant wireless private direct connectivity. The system also includes a plurality of sensors that measure the environmental characteristics and provide the thermostat unit with the measurements.

22 Claims, 4 Drawing Sheets



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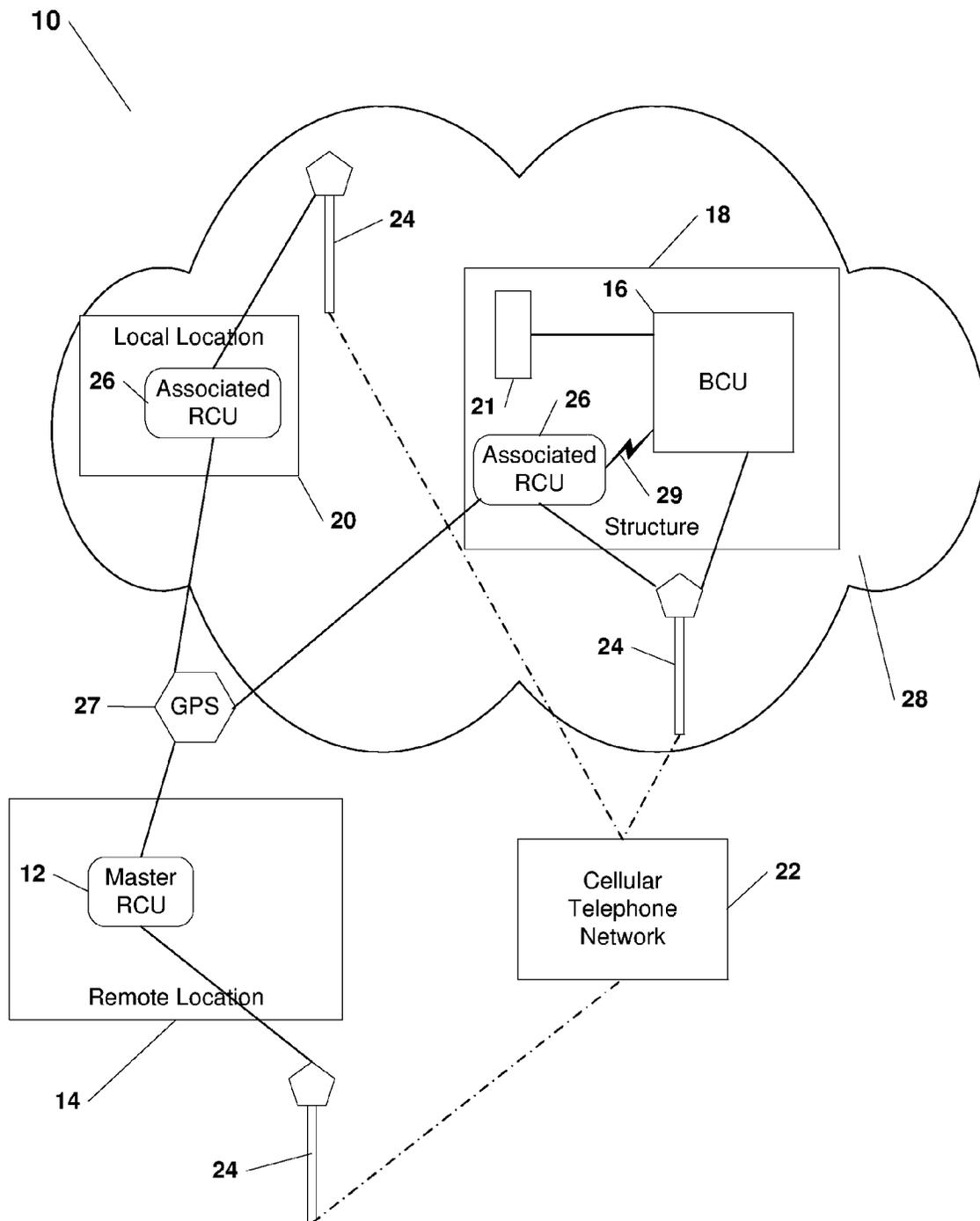


Fig. 1

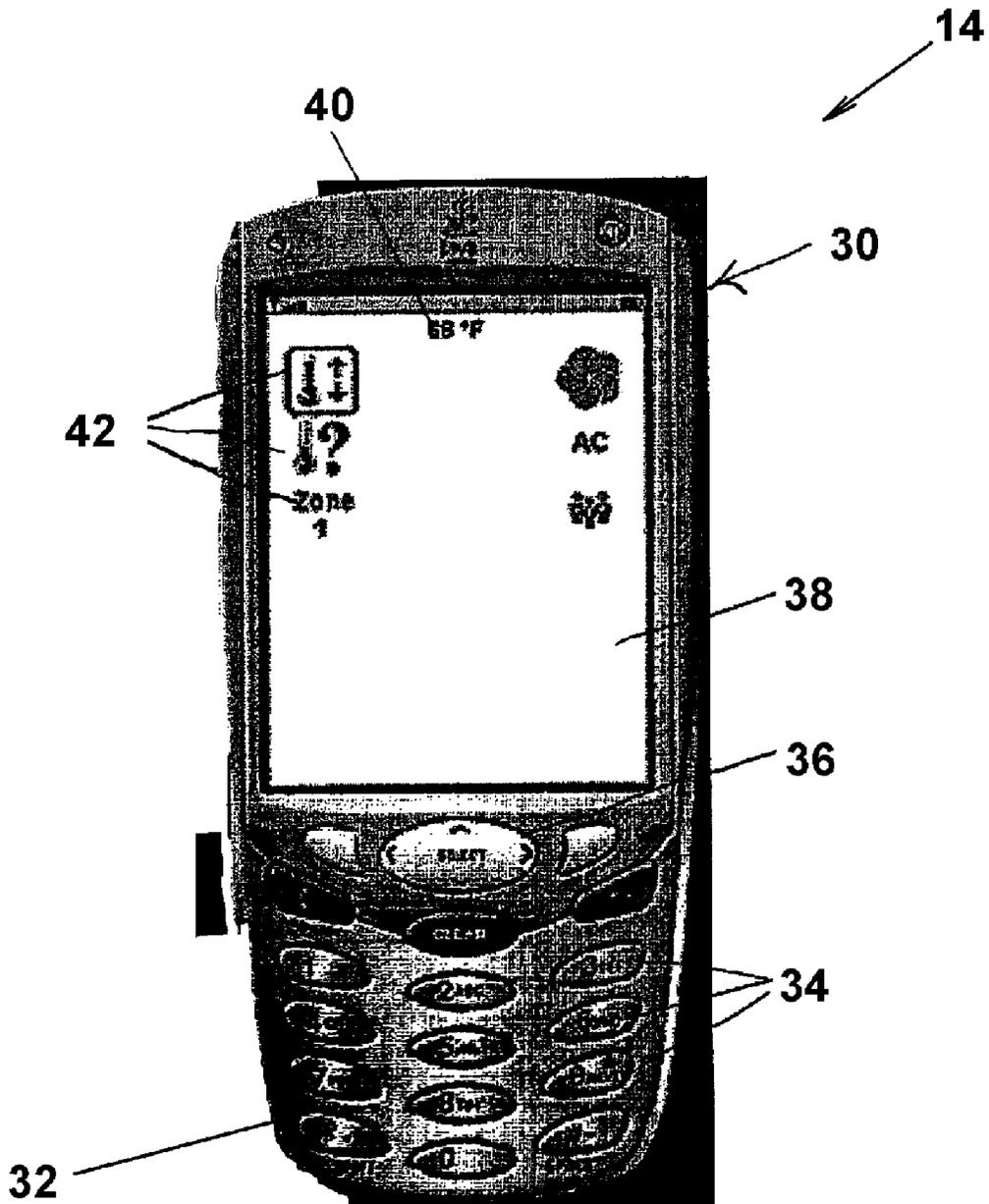
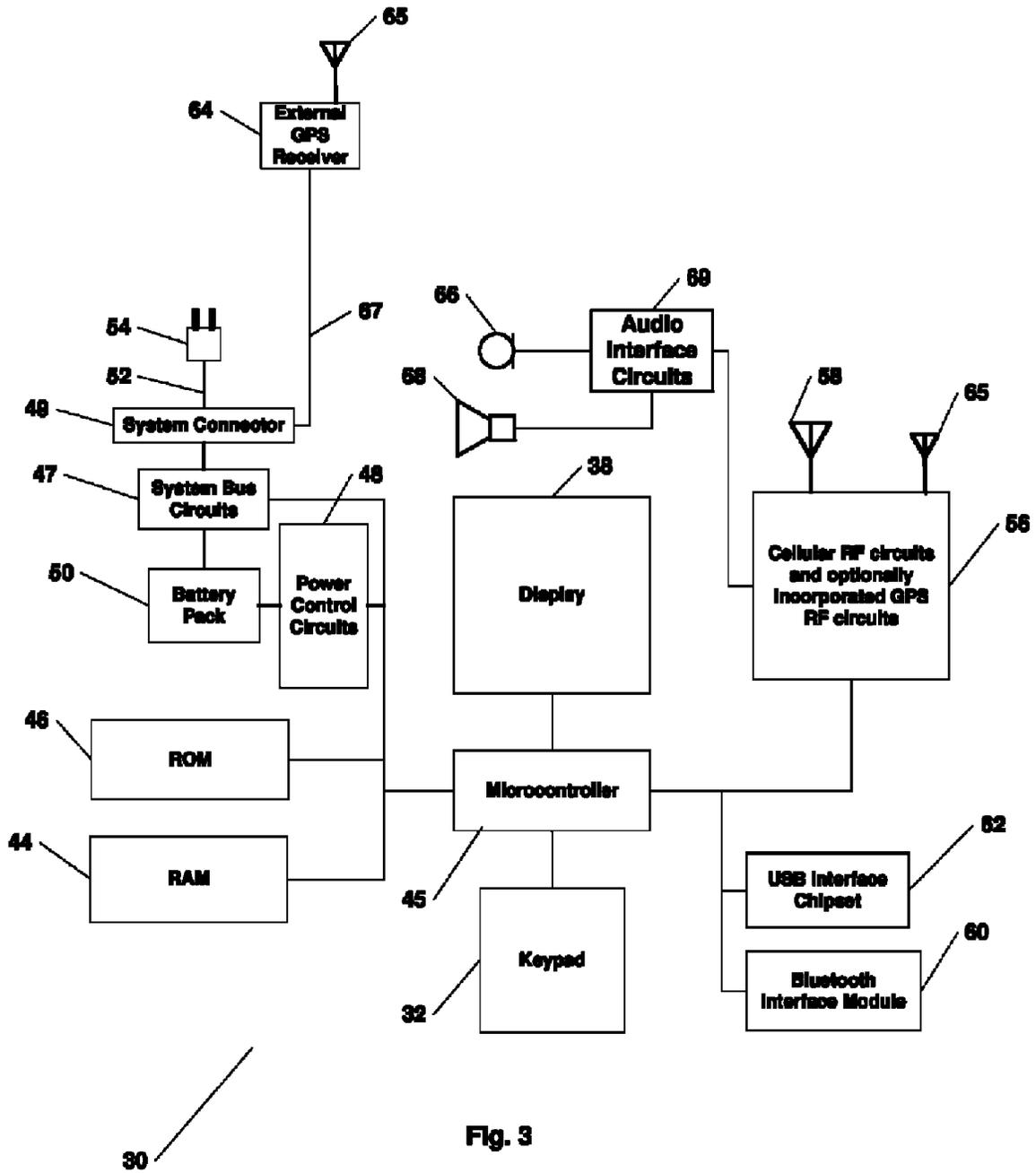


Fig. 2



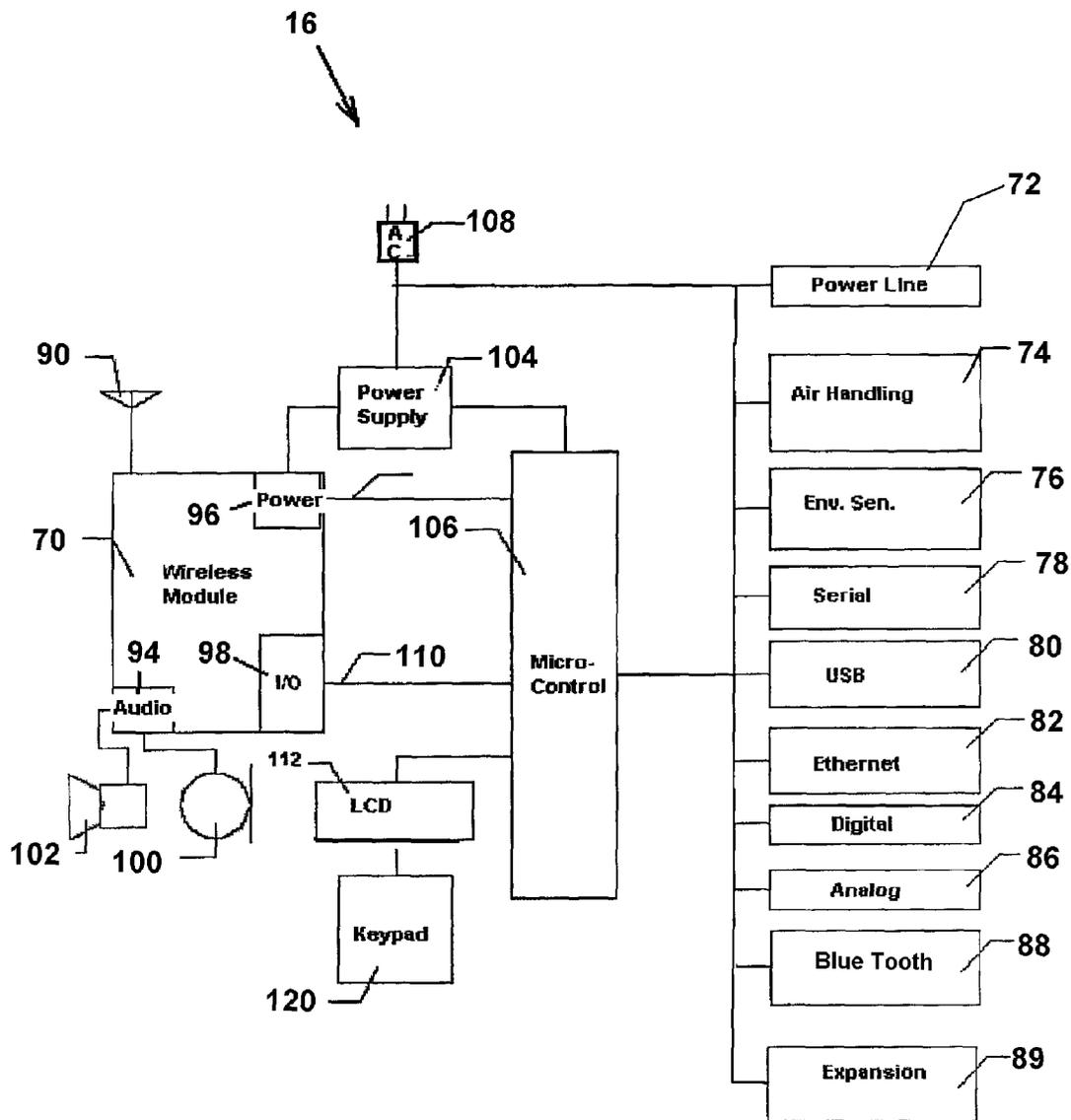


Fig. 4

1

UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR REMOTE LOCATIONS

RELATED APPLICATION

This application is a divisional of U.S. application Ser. No. 11/163,372, filed Oct. 17, 2005, pending, which is a divisional of U.S. application Ser. No. 11/160,006, filed Jun. 6, 2005, now U.S. Pat. No. 6,990,335, patented on Jan. 24, 2006, which claims the benefit of U.S. Provisional Application No. 60/522,887, filed Nov. 18, 2004, in the name of Charles Shamoon and entitled "Ubiquitous Connectivity and Control System for Remote Locations".

FIELD OF THE INVENTION

The present invention relates to a remote monitoring and control system for an environment. More specifically, the system relates to on demand bidirectional communication between a remote access unit and a multifunctional base control unit in a geographically remote location.

BACKGROUND OF THE INVENTION

In addition to a main residence, modern times provide people and families with vacation homes that are geographically remote from the regular places of residence. Also, owners of businesses generally have their place of business remote from their residence. These structures tend to be affected by changes in environmental characteristics, either natural (i.e., weather conditions), or non-natural (i.e., vandalism, break-ins, etc.). Generally, a thermostat monitors the ambient temperature and regulates a heating/cooling appliance to keep the building within the predefined temperature range thereby accomplishing the typical environmental control. The typical thermostat only monitors the ambient temperatures. Where the building is in a volatile climatic region, it is not always feasible to maintain the full functions of the appliances year round. For example, a building located in a region known for very warm temperatures, if the owner resides several hundred miles away, there would be no need to activate a cooling system on an abnormally warm day during a virtually cool season. There is no system found that monitors the ambient environmental factors within a predefined range of values, upon an exception to the predefined values, alerts the remotely located owner, and allows the owner to remotely redefine the acceptable environmental parameters. Thus a remote control system solving the aforementioned problem, as well as several others, is desired.

The home control industry is a rapidly growing, multi-billion dollar industry. This growth has been accompanied by the recent development of smart appliances and efforts to development a universal protocol for home control by major companies. The present invention provides the next major development in today's home control industry, ubiquitous connectivity and control of structure environment.

The home control industry has taken steps toward ubiquitous connectivity and control over the years, but these steps have fallen short until now. The home control industry has moved from ultrasonic remote control to infrared remote control to local RF remote control and on to land-line phone home-away-from-home remote control. The advent of improved cell phone technology provided more mobility and convenience to home-away-from-home control. High-speed and wireless Internet access has allowed connectivity to the home through home-based and wireless laptop computers.

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While an advance in connectivity, mobile Internet connectivity, like its predecessors, is not without significant challenges, especially with mobility and convenience.

The invention of the microcontroller and microcomputer has spawned a robust industry in home automation. An endless number of systems have been created by hobbyist, commercial, and industrial developers. Processes and devices for which automation has been pioneered include audio systems, video systems, security and surveillance systems, lighting systems, watering and irrigation systems, systems for measurement of vital statistics for medical patients, and garage door openers, to name a few. The typical control architecture includes a transmitter and a receiver in which a command is issued by the transmitter and is executed in response by the receiver. Communications links have used radio frequency, infrared, and ultrasonic technologies.

Other technologies used for home automation include power line carrier and telephone line. Power line carrier and telephone line systems both have the benefit of being able to use existing facility wiring for communications. Each has its own benefits and detriments. Power line systems operate on existing building electrical wiring while telephone line systems use existing telephone wiring. Electrical wiring is usually available in more locations within a building than is telephone wiring. Telephone line systems are generally more secure.

By far the most popular and ubiquitous power line carrier system is the X10. This system use transmitter, receiver, and controller modules connected to the building wiring, usually by plugging directly into an electrical outlet. Each module is individually addressed by a companion module, which is responsive to commands issued or received that are encoded with a preset digital address. The X10 system, like most power line carrier technologies, is characteristically confined to operation within a very limited area, such as within a single building. Newer interfaces have been developed to allow control of a broad range of external communications systems with X10 systems.

The need to expand the geographic range of control for a limited system, such as power line carrier, radio frequency, or infrared, led to the development of telephone interfaces, including voice, DTMF, and Caller ID. While such systems allow users to exercise control of their facilities remotely, they are not as user friendly and often use tones or cryptic, hard-to-understand, digitized voice prompts. Often a long distance call from a pay telephone was required to access the controller, which had to be interfaced with the facility telephone network.

The availability of personal computers, the Internet, and broadband networks has fueled the explosion in the number of home automation methods and devices. Controlling software is available for Windows, Macintosh, Linux, and DOS based computers. Every imaginable type of input-output port has been used to communicate data into and out of a computer. Examples of available interfaces usable for home automation and control purposes include USB, parallel port, joystick, serial (RS-232, RS-422, RS-485 and the like), audio, ActiveX, and TCP/IP. Bidirectional communications have become more prevalent, allowing a remote operator to not only control but also to observe and monitor the tasks performed by the automation system. Internet-based utilities allow control and monitoring of systems from any computer anywhere in the world.

One of the most relevant entries into the home automation universe is the cellular telephone. In their most basic mode, cell phones can be used to control the same systems accessible by conventional telephones through the dial-up POTS

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network. A more advanced method involves the use of the cell phone network's short message service ("SMS") in which text messages are sent to and received from a controlled system. SMS messages travel on the same cellular network (on the same physical layer) as standard voice calls but on a different logical channel.

SUMMARY OF THE INVENTION

The present invention uses an on-demand digital, private, and direct communications interface to overcome the shortcomings and limitations of current communications interfacing. A digital, private, and direct-connect remote controller provides instant wireless connectivity to the home from anywhere in the world without dialing a number or waiting for a number of tones to send a command or to know the status of conditions in the home; provides silent and constant direct two-way communication privately and globally, with the home for control and monitoring of key functions; eliminates limitations, immobility, and inopportunities to connect, monitor and control the home, globally; can be configured to interface with many existing and future home automation systems and technologies; provides instant ubiquitous control for the end-user; and, if so desired, eliminates the need for the PC, modems and interconnected wiring.

The digital private direct connect controller allows the end-user to finally realize true global connectivity to and control of the home.

BRIEF DESCRIPTION OF THE DRAWINGS

The above features and advantages of the present invention will become apparent upon reading the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram illustrating a connectivity and control system according to an embodiment of the present invention;

FIG. 2 is a block diagram of the remote control unit of the system of FIG. 1;

FIG. 3 is a block diagram of the essential components of the remote control unit of the system of FIG. 1; and

FIG. 4 is a block diagram of the base control unit of the system of FIG. 1.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, FIG. 1 illustrates a ubiquitous connectivity and control system 10 wherein a master remote control unit 12 at a geographically remote location 14 on demand interfaces with a base control unit 16 in a structure 18 to monitor and control associated devices 21 thereat through a short message and/or the data bearer cellular telephone network 22 including control towers 24. The system 10 further includes associated control units 26 that are enabled by the base control unit 16 to undertake select monitoring and controlling activities in a proximate area 28. Associated control units 26 and the master control unit 12 utilize the global position network 27 and/or the cellular telephone network 22 and towers 24 in order to determine their geographical locations 14, 20 and report this information back to the base control unit 16 using the short message and/or data bearer services of the cellular telephone network 22 and control towers 24.

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Referring to FIG. 2, the master remote control unit 12 and associated remote control units 26 are Java/J2ME enable cellular telephones 30 having a keypad 32 with a plurality of keys 34 including a select button 36, and an LCD display 38 for displaying textual information 40 and graphical icons 42 responsive to commands received from the base control unit 16 or from other control units configured through base control unit 16 to work with system 10.

Referring to FIG. 3, the cellular telephone 30 suitable as a remote control unit 12 or 26 includes a microcontroller 45 electrically interconnected with random access memory 44, read only memory 46, the keypad 32, and the LCD display 38. Power is supplied to the operational components by power control circuits 48 connected to rechargeable batteries 50. Wire 52 electrically interconnects charger 54 to system connector 49. Power from the system connector 49 is controlled through the system bus circuits 47 and microcontroller 45 to charge battery pack 50. The remote control unit 12 communicates with external devices through the cellular RF interface circuits 56 connected to an antenna 58, a Bluetooth module 60, a universal serial bus (USB) module 62 or through system connector 49 and system bus circuits 47. Cellular voice and data communications are transmitted to and received from the cellular telephone network 22 by the wireless cellular rf circuits 56 in a conventional manner. The Bluetooth data is received and transmitted by the Bluetooth module 60. Global satellite positioning information is received by either an external GPS module 64 or by an integrated GPS receiver incorporated into the cellular RF circuits 56. Data from the external GPS receiver 64 is communicated over serial interface cable 67 connected to system connector 49 and is then transferred to microcontroller 45 through the system bus circuits 47. Audio communications are received on the microphone 66 and are transmitted on the audio speaker 68 through audio interface circuits 69.

The custom JAVA/J2ME application software is transferred into the ROM 46 for access by the microcontroller 45. The application software can be downloaded into the ROM 46 by transmission from the cellular network 22 to the antenna 58 to the microcontroller 45, which stores the software therein. The application may also be downloaded by an external program device, such as a personal computer (not shown) by Bluetooth module 60, USB interface 62, or from the system connector 49. The RAM 44 provides service or scratchpad memory for computational use by microcontroller 45.

Referring to FIG. 4, the base control unit 16 consists a wireless module 70 communicating with a microcontroller 106 for operating a number of separate subsystems. The microcontroller communicates with each of the subsystem components using either a serial or parallel communications bus depending upon the capabilities of the particular subsystem component.

The subsystems contained within the base control unit 16 consist of either off-the-shelf integrated circuits combined with discreet components or complete modules provided by other original equipment manufacturers (OEMs). As there are many different providers of components and modules, only one particular method of systems design and integration is described herein. Those skilled in the art will recognize that there are many ways to put together components and modules to achieve a design with similar features.

The base control unit 16 includes a plurality of communication interfaces 72, 74, 76, 78, 80, 82, 84 86 and 88 for providing the means for remote control and remote monitoring of the various subsystems within the residential environment. Remote monitoring and control can be achieved through either the wireless module 70 or the Ethernet inter-

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face **82**. A multi-purpose expansion bus **89** is a proprietary bus providing a custom communications interface for accessories developed exclusively for use with the base control unit.

The base control unit **16** consists of an antenna **90** which is attached to the wireless interface module **70**. The antenna connection may be made either directly through a connector incorporated as part of the antenna or through a coaxial cable so that the antenna **90** may be mounted at a location remote from the base control unit.

The wireless interface module **70** provides both voice and data communications capabilities to the base control unit **16** through audio interface **94**, power interface **96** and I/O interface **98**. A microphone **100** and a speaker **102** provide for voice communications to the user through the audio interface **94** of the wireless interface module **70**. The power interface **96** provides power to the module **70** via power supply **104** and also allows a system microcontroller **106** to control the on/off state of the module. The power supply **104** is connected to the structure power supply through connector **108**. The I/O interface **98** provides for a data pathway for digital communications over bus **110** as well as providing the means for the system microcontroller **106** to control the various communications aspects of the wireless module **70**. Data communicated over bus **110** is RS232 ASCII or text "AT" commands commonly used in telephone modem instruction sets.

The user interacts with the base station through keypad **120** and LCD display **112** to the system microcontroller **106**. Applications software embedded into the on-board ROM of the microcontroller **106** provides the functionality for interpreting the keypad **120** input and for displaying appropriate messages on the LCD display **112**. Alternatively, the LCD display **112** may be of the well known touch pad design in which the keypad **120** functions are performed by pressing against predetermined screen areas that correspond to key designations. Further, the LCD Display **112** and keypad **120** may be eliminated completely with the base control unit **16** including web services that enable communication through one of the communications interfaces, such as the Ethernet **82** interface or the USB interface **80**, to a connected personal computer equipped with a web browser or other communications software. The base control unit **16** is TCP/IP enabled, permitting its direct connection to a local area network or directly to the Internet. With this configuration, programming and customization of the applications software in the base control unit can be performed from anywhere in the world with an Internet connection.

The interfaces of the base control unit **16** provide for the control and the monitoring of a variety of subsystems within the residential environment as well as providing a means of expanding the functionality of the base station through the use of industry standard interface technologies including universal serial bus (USB) **80**; the Ethernet (10/100/1000 Base-T) bus **82** and the RS-232 serial bus **78**.

The interface **76**, environmental sensor network, is implemented as a 1-Wire® network allowing for a number of various types of temperature, humidity, light-level and other sensors to be monitored by the base control unit **16**. The 1-Wire® network is expandable to a wide array of devices including general purpose digital and analog I/O devices which would allow for the control of actuators and relays that may be useful for control of air dampers, water control valves, electronic windows, vents and other such devices utilized within a typical residential environment.

The interface **74**, the air handling control systems interface, provides the means by which the base station serves to control the heating, air conditioning and other air handling

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equipment within the residence. This interface is designed to replace the standard thermostat that is typically used within residential heating and cooling systems. The interface **74** may provide multi-zone thermostat functions control as well as an interface to electronic air dampers. The thermostat portion of the base control unit is capable of controlling an unlimited number of zones.

The serial data bus interface **78** allows for data communications with the wide range of devices on the market that support this type of communications interface. Examples of such data communications include desk top computers, modems, and fax machines.

The USB interface **80** allows the base control unit **16** to communicate with other devices that support this type of interface. This bus can be used to expand the capabilities of the base station and add support for: persistent data storage; peripheral expansion devices (digital cameras etc); and other wireless interfaces (Bluetooth, 802.11).

The Digital Analog and I/O interfaces **84** and **86** respectively allow the base control unit to connect to a wide array of devices that interface to the real world. This allows the base control unit to serve as a bridge between simple devices and the networks to which the base station is connected. Examples of such would include: alarm systems; electronic locks; gate controls; pressure transducers; contact closures; and relays.

The multi-purpose expansion bus **89** is a proprietary bus that allows for the addition of custom accessories developed exclusively for use with the base station.

The power line interface **72** allows the base control unit to communicate over the power line to devices that support a power line communications interface. Examples of these type of interfaces are X10 and HomePlug.

The remote control units **12**, **26** take advantage of either GPS Assisted ("GPSA") technology, an external GPS unit **64** or location based information provided by the cellular network **22**. GPSA technology uses cellular-based location information provided by cellular infrastructure pursuant to the E911 protocol or mandate. With GPSA, cellular telephone towers locations have their own GPS receivers installed such that their coordinates are already known and can be readily communicated to the remote control units such that the normal three to five minute delay inherent in GPS position determination is avoided. For remote control units without GPSA technology, an external GPS can be used to communicate geographic location to the software within the remote control unit. The cellular carrier can further provide location based information to the cellular handset by using the cellular towers to determine its geographic location.

Each remote control unit **12**, **26** communicates with the base control unit **16** to affect the operational aspects thereof and peripheral equipment operatively attached thereto. For example, a remote control unit can command the base control unit **16** to enter an energy conservation mode. The user moves the cursor of the LCD screen **38** until the desired operational icon **42** is highlighted. The function associated with the icon **42** by the applications software is triggered by pressing the select button **36**. The applications software communicates the command to the base control unit **16** through the cellular telephone network **22**. The command string so transmitted is received and processed by the base control unit **16**. Upon entering this mode the base control unit **16** adjusts air handling systems, open or close dampers, open or close window coverings, and adjusts operation of a hot water heater to conserve power consumption of the home. In the preferred embodiment, the remote control units are conventional cellular telephone handsets that are equipped with a program-

ming kernel, such as Java or J2ME that enables the telephone to be customized to perform functions that are not typical of standard cellular telephone operation. For example, to use a cellular telephone that has a home automation terminal in its conventional mode, the user would have to enter a telephone number, dial into a home automation controller, and press the telephone keys to send DTMF audio signals to the controller. After the session is completed, the user has to manually disconnect from the cellular network. The data path between the remote control unit and the base control unit is SMS ("simple message service".) However, the implemented port addressing scheme allows short messages to the remote control unit to bypass standard cellular telephone functions and to operate the features of the unit independently. The desired port to be addressed on the receiving unit is configured in the user data header of the SMS message that is transmitted to the receiving unit as is well known in the art. Further, the various remote control units can send SMS information to and from one another, exclusive of the base control unit in order to change the status information for a particular user. For example, if one remote control unit desires to be inactive, a command is sent to the other remote control unit to change the personal status thereof as displayed on the other units. Similarly, the remote control units can send SMS messages to the applications running in the other remote control units to affect operation parameters of those receiving remote control units.

By way of illustration, if the base control unit notifies the remote control unit of an activation of an alarm system associated with the base control unit, the remote control unit receives textual messages and graphical indicators to alert the user. The user acknowledges receipt of the alert by pressing a button or entering a code. The communication does not involve the voice mode for communicating between the two units. Use of a conventional programmable cellular telephone readily meets the regulatory requirement that a device that participates in the cellular network be FCC or CTIA approved.

SMS port addressing allows Mobile Terminated SMS messages to be processed within the cellular telephone's application software without user intervention. Such uses include Voice Mail notifications, Wireless Access Protocol WAP, E-mail, and Phone Provisioning. The Internet Assigned Numbers Authority (<http://www.iana.com>) is responsible for defining the use of the various ports and specific ranges of numbers have been assigned for use by application software.

When the Java software application is operationally accessed by microcontroller 45 and started within the remote control unit 12, it attaches itself to a specific port for the reception of SMS messages. All Mobile Terminated (MT) SMS messages that contain a User Data Header (UDH) that indicate a port address, such as 50120, will be forwarded to the application software for processing.

The following AT command sequence is illustrative of the commands the base station unit 16 sends to the wireless module 70 over serial communications interface 110 to send a message to the remote control unit 12 to notify it that the temperature in zone 0 is currently 72 degrees:

ATE = 0\r	Turn off echoing of characters sent to the module
AT + CMGF = 0\r	Set Module in PDU Message format
AT + CMGS = 44\r	Total length of PDU is 44 octets
0041000AC10294268088000023060504C3C800003C7AB90D	
07E9DFEE724F041381EC6176BDDC13DD64A2970F <ctrl-Z>	

The base control unit 16 is configured to interact with and respond to multiple remote control units 12. If multiple remote control units 12, or associate units 26 are deployed, one of the remote control units could be considered a master and all others could be considered slaves. Specific operational characteristics of the base control unit 16 may be configured as to only respond to commands from the master remote control unit. Alternatively, the remote control units may be segregated into classes such that the base control unit responds to commands and communicates selected information to a class containing one or more remote control units. An example would be a first class consisting of remote control units operated by parents and a second class consisting of remote control units operated by children. Information pertaining to the activities of the children may be selectively reported by the base control unit to the parents. By way of illustration, when a child operating a remote control unit in the second class disarms the alarm system prior to entering the residence controlled by the base control unit, parents in the parent class are notified accordingly that the child has arrived at home. The class assignments and configurations are easily customized to provide the notifications desired by the authoritative system operators, in this case, the parents.

The GPS receiver module 64 including antenna 65 is optionally incorporated into the remote control unit 12 for allowing the remote control unit to communicate position information to the base control unit 16. The GPS may also be incorporated into wireless module 56, as in newer CDMA 2000 compatible cellular modules. This feature allows the base control unit to change its operational characteristics based upon the location of the remote control unit(s).

For example, the base control unit may adjust the water temperature and thermostats when one of the remote control units comes within a specific distance from the house. The geographic information that is acquired by the GPS subsystem in the remote control unit (whether it is a separate GPS unit or part of the module) can be compared to settings stored in either the remote control unit itself or the base control unit to provide capabilities such as Geo-Fencing, Asset Tracking, and Bio-Location (knowing where a living entity is located).

In the preferred embodiment, the position data are derived from NEMA data received from the GPS component. NEMA data includes latitude, longitude, time, velocity, and heading information. Each information packet is streamed once per second. Data are captured by the remote control unit, they are processed by its application software, and the results are transmitted by port-addressed SMS to the base control unit for proximity detection. Specific remote control units can be configured in such a way that they send a status message to the base control unit if they exceed a programmed set of boundary conditions. If desired, the base control unit can on its own initiative query the remote control unit to learn its geographic location.

Geographic location information is programmed into the base control unit through keypad 120. Additionally, the geographic location of the base control unit may be entered into a GPS-enabled remote control unit through the application software user interface. A user-determined distance is then programmed into the remote control unit. When the remote control unit travels a distance that exceeds the programmed distance from the base control unit, the remote control unit reports this information to the base control unit. The base control unit will then send this information to the appropriate user or to a predetermined class of users. This is an example of geo-fencing and would be typically used to notify parents that one of their children has traveled beyond a set distance from the home.

The base control unit communicates status information to the remote control unit either on a periodic or event-driven basis. It can initiate communications based on its aggregated inputs, or it can respond to individual requests and commands received from the remote control unit.

Examples of events that could cause the base control unit to initiate a communications session with the remote control unit include fire or burglar alarm activation, HVAC or freezer temperature thresholds exceeded, equipment failures, an air filter change necessary, a change in the home state vector, (occupied, unoccupied) or a geographical boundary condition exceeded by one of the other remote control units.

In addition to communicating status information to the remote control unit, the base control unit will, as programmed, initiate corrective action for the indicated event. For example, upon communicating an alarm activation message to a remote control unit, the base control unit, upon detecting the presence of an authorized user arriving at the local location, could disable the alarm system. Upon the detection of a member of an authorized class member, the base control unit can start the operation of the whirlpool bath in anticipation of the user's arrival, turn on specified interior and exterior lighting, or increase or decrease the thermostatic set point for the heater or air conditioner.

Yet additional geographical dependent operation or control may be provided by the inherent aspects of Bluetooth wireless technology presently available from a wide variety of professional and consumer electronic equipment manufacturers and vendors. Bluetooth radio-frequency protocol enabled devices allow totally wireless operation of devices such as computers, computer keyboards, printers, pointing devices, digital audio players, headphones, computer games, personal digital assistants, remote controls, and the like. Each Bluetooth device is characterized by one of three power classes: Class 1 is designed for long range (approximately 100 m) devices, with a maximum output power of 20 dBm; Class 2 is for ordinary range devices (approximately 10 m) devices, with a maximum output power of 4 dBm; and Class 3 is for short range devices (approximately 10 cm) devices, with a maximum output power of 0 dBm. Class 2 devices are used in the preferred embodiment as they provide a beneficially sized geographic range or fence around the local location to allow the system to provide presence detection functionality.

Each chipset in a Bluetooth enabled device has a unique serial or identification number. To enable the base control unit to recognize and respond to the presence of a Bluetooth enabled device, the device must be physically held within operable range of the control unit. The user instructs the control unit to request authorization from the Bluetooth device. An authorization code is manually entered into the base control unit and then into Bluetooth device. If the unique identification or serial number entered into each unit matches, it is stored and associated with the particular user or class of users, and the base control unit and the Bluetooth enable device are authenticated and are in communication with each other. At a periodic interval, the base control unit directs the Bluetooth master unit (located in the base control unit) to do a device discovery and report back the unique identification numbers it finds. If an identification number is not discovered, the user is assumed not within close proximity of the base control unit, which then reports the results to the designated class of users. If desired or necessary based on environmental circumstances, the Bluetooth receiver can be remotely located from the base control unit for controlled reception or to compensate for radio frequency coverage problems. The Bluetooth enabled device could be a cellular telephone, a

watch, an MP3 player, a pendant, or any other Bluetooth equipped device compatible with current Bluetooth standards.

In the preferred embodiment, the Bluetooth enabled remote control unit may be programmed using Java J2ME to send a message to other remote control units when they detect a specific base station control units. This feature allows multiple base station control units in a large environment and the case that the remote control unit handles the notification.

While the preferred embodiment employs popular Bluetooth technology, it should be appreciated and understood that other presently available technologies, such as 802.11(x), or future technologies can be used in the same manner as Bluetooth. The base control and remote control units each contain application software that is readily modifiable to adapt to a new or different technology or protocol.

Application software within the systems microcontroller **106** provides for autonomous control that is either preprogrammed at the time of manufacture or customized by the end user of the base station for their specific needs. Examples of autonomous control include: shut down of the air handling system if a fire is detected, thereby the spread of smoke and the possibility of "fanning" the fire; adjusting of indoor temperature and humidity settings depending upon conditions and information such as outdoor environmental conditions such as temperature, humidity, sun load and wind, short-term weather forecasts, family schedule and activities, structure occupancy, context, location of users; shutdown of sensitive electronic components and subsystems in cases of severe weather, or failures in other subsystems; closing and opening of windows and/or window coverings to conserve energy; control of sprinkler systems based upon current weather conditions and weather forecasts. The application software includes a macro language interpreter to enable efficient end-user customization and future expansion to the system. A macro is a miniature computer program activated by a symbol, name, or key that represents a list of commands, actions, or keystrokes. A macro allows a local or remote user to enter a single character or word to perform a series of predetermined actions.

Base control unit **16** further comprises the Ethernet interface **82** to respond to external web services generally accessible through an Internet connection. For example, at present, weather services on the Internet can be queried using the SOAP protocol. The services respond with timely weather information, typically encoded in XML. The base control unit **16** understands and interprets that received information and responds according to instructions, including macros, programmed into its application software. Such capability allows the base control unit to take actions, like causing the sprinkler system to bypass its scheduled watering cycle should rain be forecast. Other information services allow other responses. A school system's notification that schools are being released early due to inclement weather conditions could cause the base control unit to notify the class containing the parental remote control users of the decision to afford the parent the opportunity to make transportation and custodial decisions with regard to their children in the schools. The application software is RSS-aware and is capable of receiving and responding accordingly to RSS feeds. RSS ("really simple syndication") is an efficient and popular web content syndication serial data format. Any information that can be broken down into discrete data items can be syndicated via RSS. Once information about each item is in RSS format, in the present invention, the base control unit examines the feed for changes and reacts to the changes in an appropriate way. The

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Ethernet bridge function is easily updated and expanded by an upload of revised application software to the base control unit.

Messages from the remote control unit 12 to the base control unit 16 do not need to rely on port addressing for processing. The base control unit 16 uses a cellular telephone module that does not contain a user interface. The processing of SMS messages is handled by the base control unit applications software.

The base control unit 16 commands the cellular module to send newly received SMS messages directly to the base control unit 16 over the serial port using unsolicited result codes. Upon receipt of a new message the cellular module sends the following:

```
+CMT:<length><CR><LF><pdu>
```

Where

<length> is the length of the <pdu> element

<CR> is carriage return and <LF> is line feed.

<pdu> is the Short Message data in either PDU or text format. The base control unit 16 processes the data according to the content of the message data.

Although port addressing is not currently used when messages are sent from the remote control unit 12 to the base control unit 16 software (it still is used within the base control unit 16 cellular module for provisioning and control from the carriers), the system can utilize the port addressing to direct messages to specific subsystems that are tied to the base control unit 16.

The present invention thus provides an on-demand bidirectional communications interface for monitoring, controlling, and securing various environment functions and characteristics attendant the interior and exterior of a building. The system may thus monitor and control temperature, and a myriad of other environmental functions of the building include, by way of example and not limitation, temperature, power status for the building and discrete applications therein, humidity/moisture, smoke/toxic gases, structural breaches, security status, visual conditions and a host of other natural and non-natural phenomena.

The base control unit is preferably mounted at an appropriate location on a wall within the building to provide a local access for regulation. The base control unit is locally operatively interfaced with a plurality of sensors and devices systematically distributed throughout the building and communicating according to varying protocols such as infrared, radio frequency, X-10, and hard wiring.

The sensors provide continuous measurement and status of target environmental characteristics. Examples of sensor applications include utilities status, moisture and humidity detection, door and window condition, and the like. Associated controlled devices providing operational functions refrigeration, water heating, security cameras, illumination devices, and the like.

The air handling unit receives signals from the associated sensors and communicates them to the base control unit 16 that, based on the processed measured characteristics thereof, activates or deactivates one or more of the devices of the unit in response to the measurement. For example, if the temperature sensor exceeds a preset value, the HVAC unit is activated, and when the measured characteristic is within a preset value range, the unit is deactivated. In addition, when a measured characteristic exceeds a predetermined value range, an alarm signal may be transmitted to a remote control unit 14 to provide an audible, tactile, and/or visual indication. Thus, if utility sensor S2 indicates a loss of electrical, water, or communications service, a signal is sent to the remote control unit 14 and the operator thereof has the ability to take corrective

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action in response thereto. Also, the operator may invoke the a command from the remote control unit 14 to the base control unit 16 to activate a select device such as the HVAC unit, a water heater, a refrigeration appliance or other discrete device remotely in order to prepare the building for occupancy by the operator or designee.

The sensors for the system are distributed throughout the building to detect the environmental characteristics of the building. These characteristics include, but are not limited to, temperature, humidity/moisture, smoke/toxic gases, structural breaches, and a host of other natural and non-natural phenomena.

In a conventional thermostat, a temperature sensor and switch automatically control a heating or cooling appliance when the sensed temperature is beyond a preset value. The thermostatic interface of the invention would include a temperature sensor that constantly monitors the environmental temperature and control of a heating and/or cooling appliance to maintain the building at a substantially constant temperature.

The thermostatic interface also receives other environmental characteristics of the building and responds in a like manner. For example, a sensor would monitor the humidity (or moisture content of the air) of the building. If the temperature monitored by temperature sensor is within the preset range value, a conventional thermostat would not adjust the heating and/or cooling appliance to regulate the moisture content, thus presenting favorable environment for the growth on molds and mildew. The thermostatic interface receives the humidity value measured by the humidity sensor, determines that the value exceeds a predefined limit, and generates an alarm signal that is transmitted as an alarm signal via the communication link to the remote control unit. The operator receives the information and transmits a control signal from the remote access unit to the base control unit via the communication link and activates the appropriate appliance in response thereto, thus reducing the humidity value to acceptable levels and preventing the progression of mold and mildew growth.

The sensors are distributed according to a predetermined plan that effectively makes the "most likely place" for a change in environmental characteristics to be sensed. For example, several smoke/toxic gas sensors would be distributed about the ceilings and floors so as to identify the presence of smoke (i.e. fire) or carbon monoxide (i.e. toxic gas), and relaying the measured characteristic to the thermostat. Other types of sensors would be optimally placed in order to monitor the egression of water into the building, lighting striking the building, suspension or cessation of a provided utility (i.e., electric power, water and sewerprovisions, natural gas), collapse of the building or a portion thereof due to weather (i.e., tornado, hurricane, blizzard), or breach of the building security (i.e., break-ins). The sensors may be hard wired through the structure of the building. Also, the sensors may have a wireless communication. The optimal presentation would be a dual connection, such a hard-wired and wireless communication, e.g., a transmitter/receiver. This provides maximum effective monitoring of the building because the hard wiring would alleviate the need for constant battery monitoring, likewise, the wireless communication provides monitoring should the absence of electrical power be a factor. For example, the combined hard wired and wireless connection of the sensors to the unit allows the monitoring of the building and generates the alarm when the power is lost due to an area wide electrical outage. The unit transmits that information (i.e., the loss of electrical power) to the remote control unit and the operator is aware that the electrical power is

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absent. If the loss of electrical power were due to a nefarious figure seeking to breach the building, i.e., breaking a window to gain access, a security sensor would still be able to provide the base control unit with an indication that the building has a security breach. The base control unit, operating under an alternate electrical power supply such as a backup battery, would generate a subsequent alarm signal and transmit the subsequent alarm signal for routing through the direct connect wireless for immediate transmission to the remote control unit, thereby alerting the operator that in addition to the loss of electrical power, the security of the building has been breached. The operator can thereby contact the law enforcement facility of the local jurisdiction and have an immediate response. If the remote control units are organized in classes, such as "managers", the information would be almost simultaneously provided to each member of the class who would have a need to receive and react to it.

In addition to main residence use, the system is typically suited for a vacation/second dwelling, a business concern, or any building structure that is not constantly occupied. For example, if the thermostat control system is installed in a vacation home in one locality, the operator may effectively be in any other portion of the globe so long as an effective communication link is provided with the remote control unit

14. Multiple base station units could be controlled through a single cellular phone for those instances where a person desires to have systems installed in multiple residences. The application software uses the Source Address field of the message to distinguish between different base control units

16. It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

What is claimed is:

1. A wireless system comprising:

an environmental device;

a base unit operatively interfaced with the environmental device and configured to control an operation of the environmental device;

a remote unit having wireless connectivity and being configured to send and receive short message service (SMS) messages; and

a wireless module operatively interfaced with the base unit and configured to provide wireless connectivity between the base unit and the remote unit,

wherein the base unit is configured to send a first SMS message, including current environmental information, to the remote unit through the wireless module,

wherein the remote unit is configured to send a second SMS message, including a command for the environmental device, to the base unit through the wireless module, and

wherein the base unit is configured to receive the second SMS message, including the command, and to send the command to the environmental device to control the operation of the environmental device.

2. The system as recited in claim 1 wherein said environmental device includes electronic and electromechanical switching portions interfaced with said environmental device.

3. The system as recited in claim 1 wherein said base unit is a microcontroller-based processing unit having customizable application specific software.

4. The system as recited in claim 1 wherein said remote unit is a cellular telephone handset with custom programmability.

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5. The system as recited in claim 4 wherein said custom programmability is a JAVA programming kernel.

6. The system as recited in claim 4 wherein said custom programmability is a J2ME programming kernel.

7. The system as recited in claim 1 wherein said wireless connectivity includes a transmitting and receiving module in said base unit and a transmitting and receiving unit in said remote unit operatively communicating with each other over a cellular telephone network.

8. The system as recited in claim 1 wherein the remote unit includes a liquid crystal display module.

9. The system as recited in claim 8 wherein said liquid crystal module includes selectable graphic icons corresponding to current environmental information being monitored or controlled.

10. The system as recited in claim 1, wherein the remote unit is configured to selectively disable transmission of SMS messages from the base unit.

11. A wireless system comprising:

an environmental device configured to send environmental information, and adapted to receive a command to control an operation of the environmental device;

a remote unit having wireless connectivity and being configured to:

receive a first short message service (SMS) message, wherein the first SMS message includes the environmental information;

notify a user of said remote unit of receipt of the first SMS message; and

send a second SMS message, wherein the second SMS message includes the command; and

a wireless base unit configured to:

receive the environmental information from the environmental device;

transmit the first SMS message to the remote unit;

receive the second SMS message from the remote unit; and

send the command to the environmental device.

12. The system of claim 11 wherein the wireless connectivity connection further comprises a first wireless connection interfacing with the base unit, a second wireless connection interfacing with the remote unit, and a non-wireless connection interfacing between the first wireless connection and the second wireless connection.

13. The system of claim 11 wherein the environmental device includes electronic and electromechanical switching portions for controlling the environmental information.

14. The system of claim 11 wherein the base unit further comprises a microcontroller-based processing unit having customizable application specific software.

15. The system of claim 11 wherein the remote unit further comprises a cellular telephone handset.

16. The system of claim 15 wherein the cellular telephone handset includes at least one of a customizable JAVA programming kernel and a customizable J2ME programming kernel.

17. The system of claim 11 further comprising a cellular telephone network.

18. A base unit configured to communicate with an environmental device and to communicate with a remote unit having wireless connectivity, the base unit comprising:

a communication interface configured to receive environmental information from the environmental device and to send a command to the environmental device;

a wireless module configured to send a first message to the remote unit and to receive a second message from the remote unit, wherein the first message is a first short

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message service (SMS) message including the environmental information, and wherein the second message is a second short message service (SMS) message including the command to the environmental device; and
 a microcontroller configured to process the second message including the command, and to send the command through the communication interface to the environmental device.

19. A communication system having wireless connectivity, the communication system comprising:
 a base unit operatively interfaced with an environmental device, and configured to receive a current status of an environmental device;
 a transmitter associated with said base unit, and configured to send a first message to a remote unit having wireless connectivity, wherein the first message is a wireless message including the current status of the environmental device;
 a receiver associated with said base unit, and configured to receive a second message from the remote unit, wherein the second message is a wireless message including a command for the environmental device; and
 a controller operatively associated with the base unit and operatively connected with the environmental device, and configured to send the command to the environmental device.

20. A wireless system comprising:
 a base unit operatively interfaced with an environmental device for controlling an environmental condition in a structure;
 a receiver associated with said base unit, and adapted for receiving a first wireless message from a remote unit having wireless connectivity, wherein the first wireless message includes a command for the environmental device;
 a controller operatively associated with said base unit, and operatively connected with the environmental device for executing the command; and

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a transmitter operatively associated with the controller for sending a second wireless message to the remote unit, wherein the second wireless message includes information indicating that the command has been executed.

21. A base unit configured to communicate with an environmental device and to communicate with a remote unit having wireless connectivity, the base unit comprising:
 a communication interface configured to receive environmental information from the environmental device and to send a command to the environmental device;
 a wireless module configured to send a first message to the remote unit and to receive a second message from the remote unit, wherein the first message includes the environmental information and travels via short message and/or data bearer services, and wherein the second message includes the command to the environmental device and travels via short message and/or data bearer services; and
 a microcontroller configured to process the second message including the command, and to send the command through the communication interface to the environmental device.

22. A base unit configured to communicate with an environmental device and to communicate with a remote unit having wireless connectivity, the base unit comprising:
 a controller configured to communicate with the environmental device; and
 a wireless module configured to:
 receive a control message from the remote unit via short message and/or data bearer services, said control message comprising control information for controlling the environmental device;
 create a control command for the environmental device based on the control information;
 send the control command to the environmental device via the controller; and
 send a status message indicating execution of said control information to the remote device.

* * * * *

EXHIBIT B



US009602655B2

(12) **United States Patent**
Shamoon et al.

(10) **Patent No.:** **US 9,602,655 B2**
(45) **Date of Patent:** ***Mar. 21, 2017**

- (54) **UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR REMOTE LOCATIONS**
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- (73) Assignee: **Ubiquitous Connectivity, LP**, Little Elm, TX (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

- (52) **U.S. Cl.**
CPC **H04M 3/42** (2013.01); **G01D 21/00** (2013.01); **G08C 17/02** (2013.01);
(Continued)
- (58) **Field of Classification Search**
CPC H04M 1/72533; H04M 2250/16; H04M 2250/22; H04M 2250/12; H04M 11/007;
(Continued)

- (56) **References Cited**

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- (22) Filed: **Oct. 11, 2011**

- (65) **Prior Publication Data**
US 2012/0094638 A1 Apr. 19, 2012

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(Continued)

- (51) **Int. Cl.**
H04M 3/00 (2006.01)
H04M 3/42 (2006.01)
(Continued)

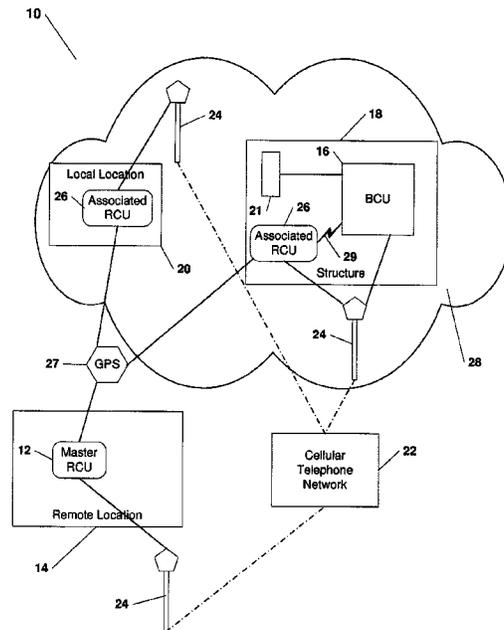
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Primary Examiner — Olumide T. Ajibade-Akonai
(57) **ABSTRACT**

A thermostat control system for monitoring and controlling environmental characteristics of a building includes a base station unit and a remote access unit continuously interfacing through instant wireless private direct connectivity. The system also includes a plurality of sensors that measure the environmental characteristics and provide the thermostat unit with the measurements.

24 Claims, 4 Drawing Sheets



Related U.S. Application Data

division of application No. 11/163,372, filed on Oct. 17, 2005, now Pat. No. 7,257,397, which is a division of application No. 11/160,006, filed on Jun. 6, 2005, now Pat. No. 6,990,335.

(60) Provisional application No. 60/522,887, filed on Nov. 18, 2004.

(51) **Int. Cl.**

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H04L 12/28 (2006.01)
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H04W 48/08 (2009.01)
H04W 64/00 (2009.01)
H04W 84/10 (2009.01)
H04W 88/08 (2009.01)

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CPC **H04L 12/2825** (2013.01); **H04L 12/2827** (2013.01); **H04M 1/72533** (2013.01); **G08C 2201/42** (2013.01); **G08C 2201/50** (2013.01); **G08C 2201/91** (2013.01); **G08C 2201/93** (2013.01); **H04M 2203/1016** (2013.01); **H04M 2207/18** (2013.01); **H04W 48/08** (2013.01); **H04W 64/00** (2013.01); **H04W 84/105** (2013.01); **H04W 88/08** (2013.01)

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 USPC 455/466, 404.2, 414.2, 456.1-456.6, 455/418-420, 566; 340/539.11, 539.13, 340/539.22, 539.24, 539.27, 539.29, 540
 See application file for complete search history.

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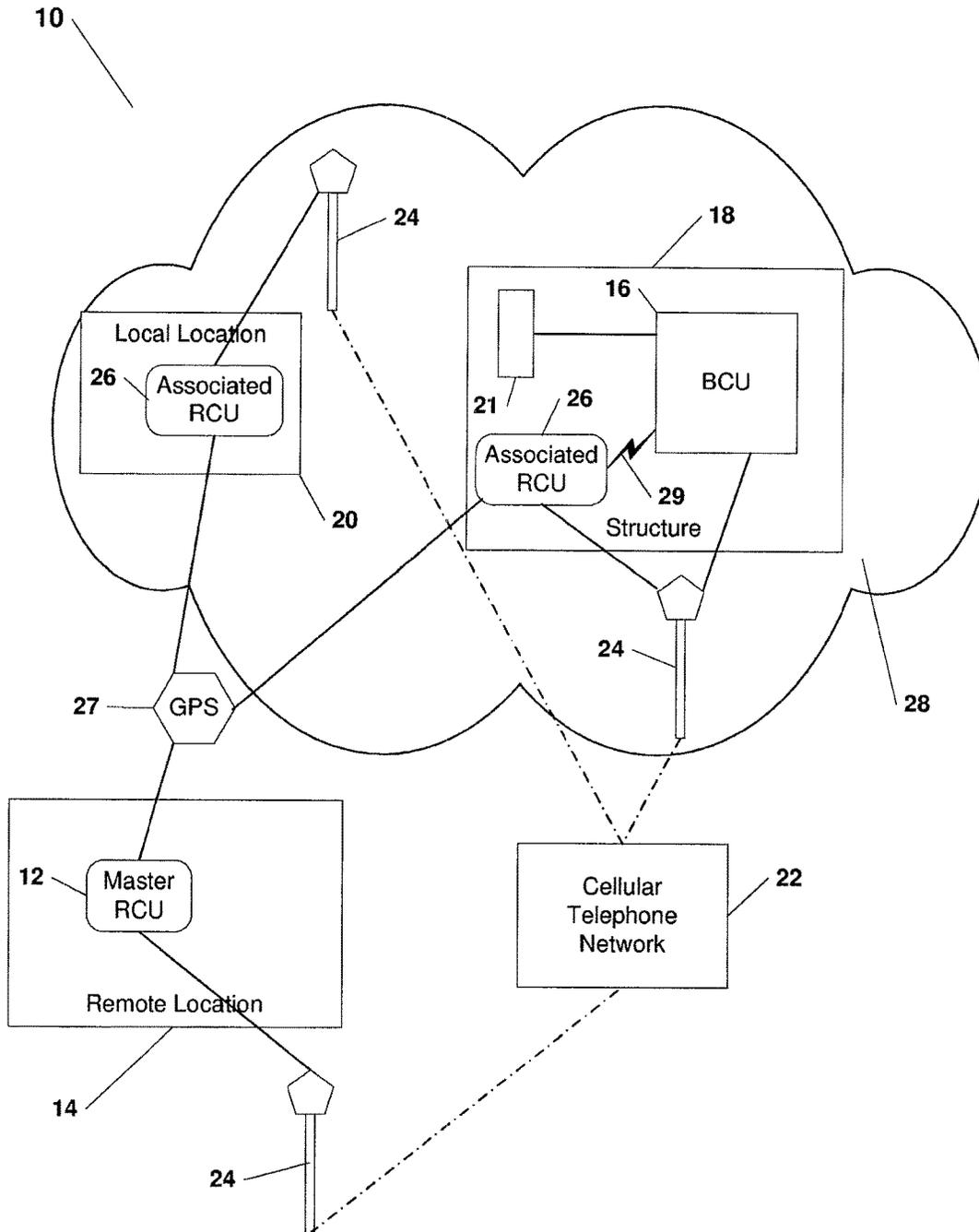


Fig. 1

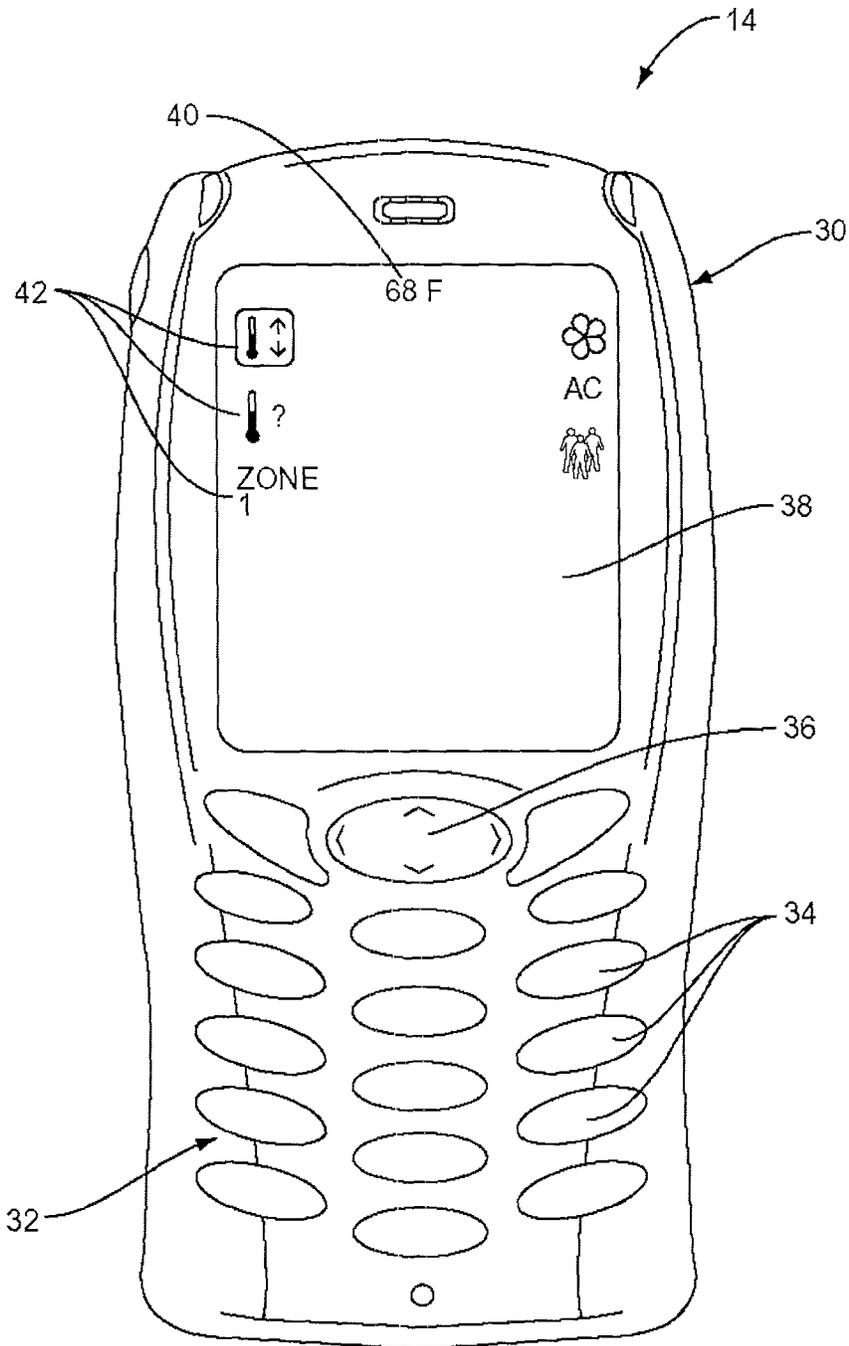


FIG. 2

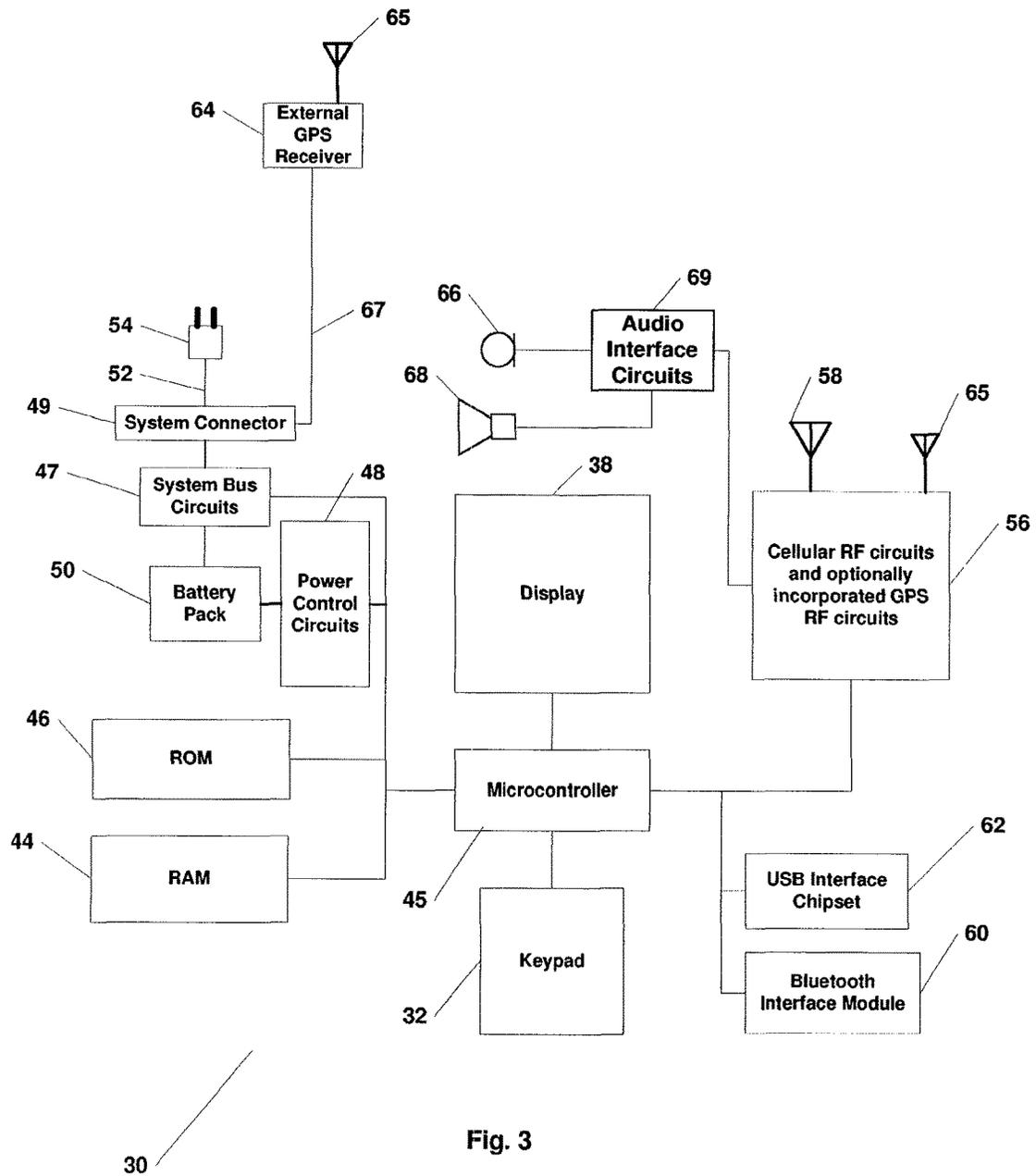


Fig. 3

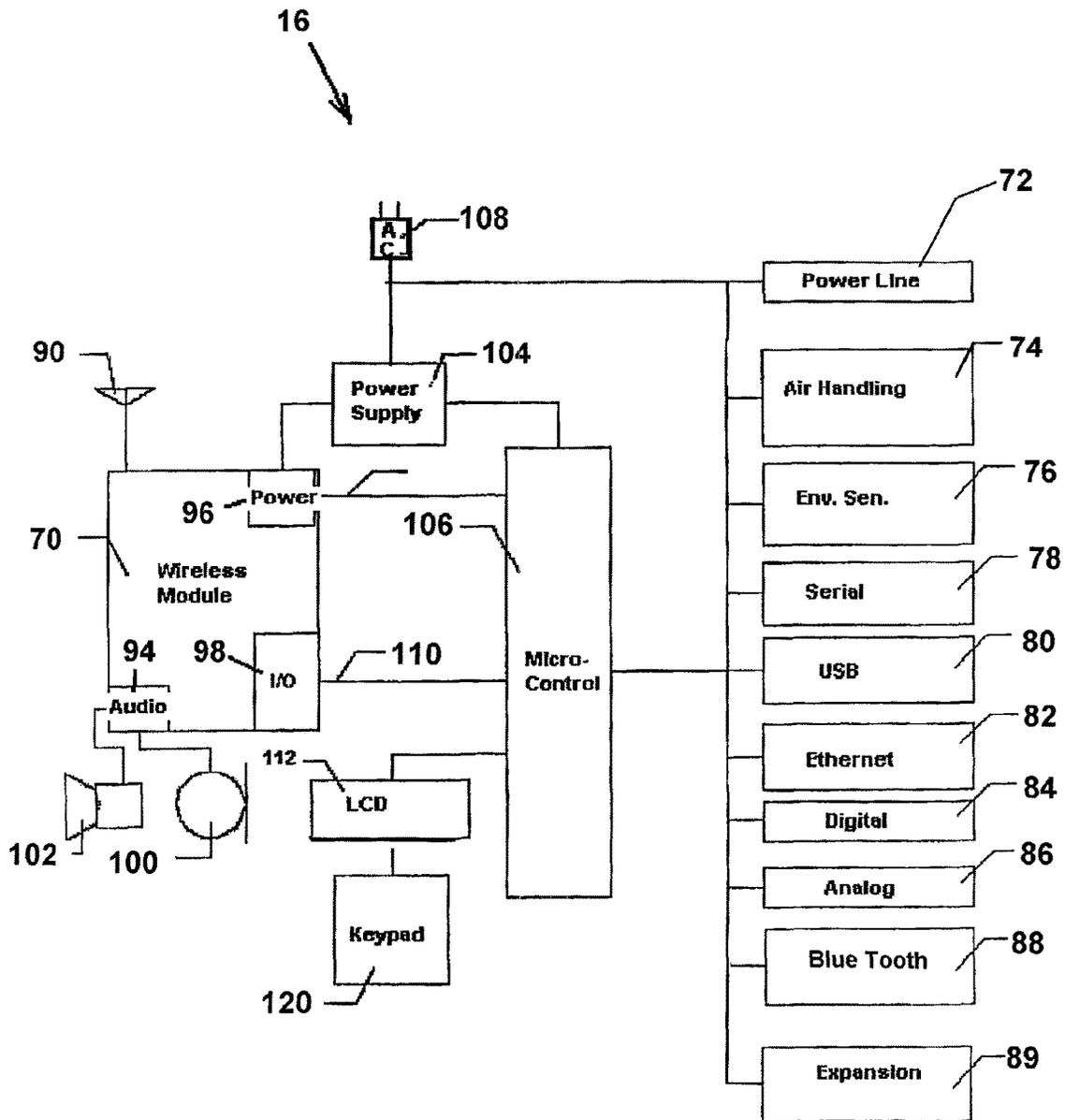


Fig. 4

UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR REMOTE LOCATIONS

RELATED APPLICATION

This application is a continuation application of U.S. application Ser. No. 11/686,993, filed Mar. 16, 2007, pending, which is a divisional of U.S. application Ser. No. 11/163,372, filed Oct. 17, 2005, now U.S. Pat. No. 7,257,397, patented on Aug. 14, 2007, which is a divisional of U.S. application Ser. No. 11/160,006, filed Jun. 6, 2005, now U.S. Pat. No. 6,990,335, patented on Jan. 24, 2006, which claims the benefit of U.S. Provisional Application No. 60/522,887, filed Nov. 18, 2004, in the name of Charles Shamoon and entitled "Ubiquitous Connectivity and Control System for Remote Locations". All of the above enumerated applications are hereby incorporated by reference in their entirety.

FIELD OF THE INVENTION

The present invention relates to a remote monitoring and control system for an environment. More specifically, the system relates to on demand bidirectional communication between a remote access unit and a multifunctional base control unit in a geographically remote location.

BACKGROUND OF THE INVENTION

In addition to a main residence, modern times provide people and families with vacation homes that are geographically remote from the regular places of residence. Also, owners of businesses generally have their place of business remote from their residence. These structures tend to be affected by changes in environmental characteristics, either natural (i.e., weather conditions), or non-natural (i.e., vandalism, break-ins, etc.). Generally, a thermostat monitors the ambient temperature and regulates a heating/cooling appliance to keep the building within the predefined temperature range thereby accomplishing the typical environmental control. The typical thermostat only monitors the ambient temperatures. Where the building is in a volatile climatic region, it is not always feasible to maintain the full functions of the appliances year round. For example, a building located in a region known for very warm temperatures, if the owner resides several hundred miles away, there would be no need to activate a cooling system on an abnormally warm day during a virtually cool season. There is no system found that monitors the ambient environmental factors within a predefined range of values, upon an exception to the predefined values, alerts the remotely located owner, and allows the owner to remotely redefine the acceptable environmental parameters. Thus a remote control system solving the aforementioned problem, as well as several others, is desired.

The home control industry is a rapidly growing, multi-billion dollar industry. This growth has been accompanied by the recent development of smart appliances and efforts to development a universal protocol for home control by major companies. The present invention provides the next major development in today's home control industry, ubiquitous connectivity and control of structure environment.

The home control industry has taken steps toward ubiquitous connectivity and control over the years, but these steps have fallen short until now. The home control industry has moved from ultrasonic remote control to infrared remote control to local RF remote control and on to land-line phone home-away-from-home remote control. The advent of

improved cell phone technology provided more mobility and convenience to home-away-from-home control. High-speed and wireless Internet access has allowed connectivity to the home through home-based and wireless laptop computers. While an advance in connectivity, mobile Internet connectivity, like its predecessors, is not without significant challenges, especially with mobility and convenience.

The invention of the microcontroller and microcomputer has spawned a robust industry in home automation. An endless number of systems have been created by hobbyist, commercial, and industrial developers. Processes and devices for which automation has been pioneered include audio systems, video systems, security and surveillance systems, lighting systems, watering and irrigation systems, systems for measurement of vital statistics for medical patients, and garage door openers, to name a few. The typical control architecture includes a transmitter and a receiver in which a command is issued by the transmitter and is executed in response by the receiver. Communications links have used radio frequency, infrared, and ultrasonic technologies.

Other technologies used for home automation include power line carrier and telephone line. Power line carrier and telephone line systems both have the benefit of being able to use existing facility wiring for communications. Each has its own benefits and detriments. Power line systems operate on existing building electrical wiring while telephone line systems use existing telephone wiring. Electrical wiring is usually available in more locations within a building than is telephone wiring. Telephone line systems are generally more secure.

By far the most popular and ubiquitous power line carrier system is the X10. This system use transmitter, receiver, and controller modules connected to the building wiring, usually by plugging directly into an electrical outlet. Each module is individually addressed by a companion module, which is responsive to commands issued or received that are encoded with a preset digital address. The X10 system, like most power line carrier technologies, is characteristically confined to operation within a very limited area, such as within a single building. Newer interfaces have been developed to allow control of a broad range of external communications systems with X10 systems.

The need to expand the geographic range of control for a limited system, such as power line carrier, radio frequency, or infrared, led to the development of telephone interfaces, including voice, DTMF, and Caller ID. While such systems allow users to exercise control of their facilities remotely, they are not as user friendly and often use tones or cryptic, hard-to-understand, digitized voice prompts. Often a long distance call from a pay telephone was required to access the controller, which had to be interfaced with the facility telephone network.

The availability of personal computers, the Internet, and broadband networks has fueled the explosion in the number of home automation methods and devices. Controlling software is available for Windows, Macintosh, Linux, and DOS based computers. Every imaginable type of input-output port has been used to communicate data into and out of a computer. Examples of available interfaces usable for home automation and control purposes include USB, parallel port, joystick, serial (RS-232, RS-422, RS-485 and the like), audio, ActiveX, and TCP/IP. Bidirectional communications have become more prevalent, allowing a remote operator to not only control but also to observe and monitor the tasks

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performed by the automation system. Internet-based utilities allow control and monitoring of systems from any computer anywhere in the world.

One of the most relevant entries into the home automation universe is the cellular telephone. In their most basic mode, cell phones can be used to control the same systems accessible by conventional telephones through the dial-up POTS network. A more advanced method involves the use of the cell phone network's short message service ("SMS") in which text messages are sent to and received from a controlled system. SMS messages travel on the same cellular network (on the same physical layer) as standard voice calls but on a different logical channel.

SUMMARY OF THE INVENTION

The present invention uses an on-demand digital, private, and direct communications interface to overcome the shortcomings and limitations of current communications interfacing. A digital, private, and direct-connect remote controller provides instant wireless connectivity to the home from anywhere in the world without dialing a number or waiting for a number of tones to send a command or to know the status of conditions in the home; provides silent and constant direct two-way communication privately and globally, with the home for control and monitoring of key functions; eliminates limitations, immobility, and inopportunities to connect, monitor and control the home, globally; can be configured to interface with many existing and future home automation systems and technologies; provides instant ubiquitous control for the end-user; and, if so desired, eliminates the need for the PC, modems and interconnected wiring.

The digital private direct connect controller allows the end-user to finally realize true global connectivity to and control of the home.

BRIEF DESCRIPTION OF THE DRAWINGS

The above features and advantages of the present invention will become apparent upon reading the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram illustrating a connectivity and control system according to an embodiment of the present invention;

FIG. 2 is a block diagram of the remote control unit of the system of FIG. 1;

FIG. 3 is a block diagram of the essential components of the remote control unit of the system of FIG. 1; and

FIG. 4 is a block diagram of the base control unit of the system of FIG. 1.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, FIG. 1 illustrates a ubiquitous connectivity and control system 10 wherein a master remote control unit 12 at a geographically remote location 14 on demand interfaces with a base control unit 16 in a structure 18 to monitor and control associated devices 21 thereat through a short message and/or the data bearer cellular telephone network 22 including control towers 24. The system 10 further includes associated control units 26 that are enabled by the base control unit 16 to undertake select monitoring and controlling activities in a proximate area 28.

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Associated control units 26 and the master control unit 12 utilize the global position network 27 and/or the cellular telephone network 22 and towers 24 in order to determine their geographical locations 14, 20 and report this information back to the base control unit 16 using the short message and/or data bearer services of the cellular telephone network 22 and control towers 24.

Referring to FIG. 2, the master remote control unit 12 and associated remote control units 26 are Java/J2ME enable cellular telephones 30 having a keypad 32 with a plurality of keys 34 including a select button 36, and an LCD display 38 for displaying textual information 40 and graphical icons 42 responsive to commands received from the base control unit 16 or from other control units configured through base control unit 16 to work with system 10.

Referring to FIG. 3, the cellular telephone 30 suitable as a remote control unit 12 or 26 includes a microcontroller 45 electrically interconnected with random access memory 44, read only memory 46, the keypad 32, and the LCD display 38. Power is supplied to the operational components by power control circuits 48 connected to rechargeable batteries 50. Wire 52 electrically interconnects charger 54 to system connector 49. Power from the system connector 49 is controlled through the system bus circuits 47 and microcontroller 45 to charge battery pack 50. The remote control unit 12 communicates with external devices through the cellular RF interface circuits 56 connected to an antenna 58, a Bluetooth module 60, a universal serial bus (USB) module 62 or through system connector 49 and system bus circuits 47. Cellular voice and data communications are transmitted to and received from the cellular telephone network 22 by the wireless cellular rf circuits 56 in a conventional manner. The Bluetooth data is received and transmitted by the Bluetooth module 60. Global satellite positioning information is received by either an external GPS module 64 or by an integrated GPS receiver incorporated into the cellular RF circuits 56. Data from the external GPS receiver 64 is communicated over serial interface cable 67 connected to system connector 49 and is then transferred to microcontroller 45 through the system bus circuits 47. Audio communications are received on the microphone 66 and are transmitted on the audio speaker 68 through audio interface circuits 69.

The custom JAVA/J2ME application software is transferred into the ROM 46 for access by the microcontroller 45. The application software can be downloaded into the ROM 46 by transmission from the cellular network 22 to the antenna 58 to the microcontroller 45, which stores the software therein. The application may also be downloaded by an external program device, such as a personal computer (not shown) by Bluetooth module 60, USB interface 62, or from the system connector 49. The RAM 44 provides service or scratchpad memory for computational use by microcontroller 45.

Referring to FIG. 4, the base control unit 16 consists a wireless module 70 communicating with a microcontroller 106 for operating a number of separate subsystems. The microcontroller communicates with each of the subsystem components using either a serial or parallel communications bus depending upon the capabilities of the particular subsystem component.

The subsystems contained within the base control unit 16 consist of either off-the-shelf integrated circuits combined with discreet components or complete modules provided by other original equipment manufacturers (OEMs). As there are many different providers of components and modules, only one particular method of systems design and integra-

tion is described herein. Those skilled in the art will recognize that there are many ways to put together components and modules to achieve a design with similar features.

The base control unit **16** includes a plurality of communication interfaces **72, 74, 76, 78, 80, 82, 84, 86** and **88** for providing the means for remote control and remote monitoring of the various subsystems within the residential environment. Remote monitoring and control can be achieved through either the wireless module **70** or the Ethernet interface **82**. A multi-purpose expansion bus **89** is a proprietary bus providing a custom communications interface for accessories developed exclusively for use with the base control unit.

The base control unit **16** consists of an antenna **90** which is attached to the wireless interface module **70**. The antenna connection may be made either directly through a connector incorporated as part of the antenna or through a coaxial cable so that the antenna **90** may be mounted at a location remote from the base control unit.

The wireless interface module **70** provides both voice and data communications capabilities to the base control unit **16** through audio interface **94**, power interface **96** and I/O interface **98**. A microphone **100** and a speaker **102** provide for voice communications to the user through the audio interface **94** of the wireless interface module **70**. The power interface **96** provides power to the module **70** via power supply **104** and also allows a system microcontroller **106** to control the on/off state of the module. The power supply **104** is connected to the structure power supply through connector **108**. The I/O interface **98** provides for a data pathway for digital communications over bus **110** as well as providing the means for the system microcontroller **106** to control the various communications aspects of the wireless module **70**. Data communicated over bus **110** is RS232 ASCII or text "AT" commands commonly used in telephone modem instruction sets.

The user interacts with the base station through keypad **120** and LCD display **112** to the system microcontroller **106**. Applications software embedded into the on-board ROM of the microcontroller **106** provides the functionality for interpreting the keypad **120** input and for displaying appropriate messages on the LCD display **112**. Alternatively, the LCD display **112** may be of the well known touch pad design in which the keypad **120** functions are performed by pressing against predetermined screen areas that correspond to key designations. Further, the LCD Display **112** and keypad **120** may be eliminated completely with the base control unit **16** including web services that enable communication through one of the communications interfaces, such as the Ethernet **82** interface or the USB interface **80**, to a connected personal computer equipped with a web browser or other communications software. The base control unit **16** is TCP/IP enabled, permitting its direct connection to a local area network or directly to the Internet. With this configuration, programming and customization of the applications software in the base control unit can be performed from anywhere in the world with an Internet connection.

The interfaces of the base control unit **16** provide for the control and the monitoring of a variety of subsystems within the residential environment as well as providing a means of expanding the functionality of the base station through the use of industry standard interface technologies including universal serial bus (USB) **80**; the Ethernet (10/100/1000 Base-T) bus **82** and the RS-232 serial bus **78**.

The interface **76**, environmental sensor network, is implemented as a 1-Wire® network allowing for a number of various types of temperature, humidity, light-level and other

sensors to be monitored by the base control unit **16**. The 1-Wires network is expandable to a wide array of devices including general purpose digital and analog I/O devices which would allow for the control of actuators and relays that may be useful for control of air dampers, water control valves, electronic windows, vents and other such devices utilized within a typical residential environment.

The interface **74**, the air handling control systems interface, provides the means by which the base station serves to control the heating, air conditioning and other air handling equipment within the residence. This interface is designed to replace the standard thermostat that is typically used within residential heating and cooling systems. The interface **74** may provide multi-zone thermostat functions control as well as an interface to electronic air dampers. The thermostat portion of the base control unit is capable of controlling an unlimited number of zones.

The serial data bus interface **78** allows for data communications with the wide range of devices on the market that support this type of communications interface. Examples of such data communications include desk top computers, modems, and fax machines.

The USB interface **80** allows the base control unit **16** to communicate with other devices that support this type of interface. This bus can be used to expand the capabilities of the base station and add support for: persistent data storage; peripheral expansion devices (digital cameras etc); and other wireless interfaces (Bluetooth, 802.11).

The Digital Analog and I/O interfaces **84** and **86** respectively allow the base control unit to connect to a wide array of devices that interface to the real world. This allows the base control unit to serve as a bridge between simple devices and the networks to which the base station is connected. Examples of such would include: alarm systems; electronic locks; gate controls; pressure transducers; contact closures; and relays.

The multi-purpose expansion bus **89** is a proprietary bus that allows for the addition of custom accessories developed exclusively for use with the base station.

The power line interface **72** allows the base control unit to communicate over the power line to devices that support a power line communications interface. Examples of these type of interfaces are X10 and HomePlug.

The remote control units **12, 26** take advantage of either GPS Assisted ("GPSA") technology, an external GPS unit **64** or location based information provided by the cellular network **22**. GPSA technology uses cellular-based location information provided by cellular infrastructure pursuant to the E911 protocol or mandate. With GPSA, cellular telephone towers locations have their own GPS receivers installed such that their coordinates are already known and can be readily communicated to the remote control units such that the normal three to five minute delay inherent in GPS position determination is avoided. For remote control units without GPSA technology, an external GPS can be used to communicate geographic location to the software within the remote control unit. The cellular carrier can further provide location based information to the cellular handset by using the cellular towers to determine its geographic location.

Each remote control unit **12, 26** communicates with the base control unit **16** to affect the operational aspects thereof and peripheral equipment operatively attached thereto. For example, a remote control unit can command the base control unit **16** to enter an energy conservation mode. The user moves the cursor of the LCD screen **38** until the desired operational icon **42** is highlighted. The function associated

with the icon **42** by the applications software is triggered by pressing the select button **36**. The applications software communicates the command to the base control unit **16** through the cellular telephone network **22**. The command string so transmitted is received and processed by the base control unit **16**. Upon entering this mode the base control unit **16** adjusts air handling systems, open or close dampers, open or close window coverings, and adjusts operation of a hot water heater to conserve power consumption of the home. In the preferred embodiment, the remote control units are conventional cellular telephone handsets that are equipped with a programming kernel, such as Java or J2ME that enables the telephone to be customized to perform functions that are not typical of standard cellular telephone operation. For example, to use a cellular telephone that has a home automation terminal in its conventional mode, the user would have to enter a telephone number, dial into a home automation controller, and press the telephone keys to send DTMF audio signals to the controller. After the session is completed, the user has to manually disconnect from the cellular network. The data path between the remote control unit and the base control unit is SMS ("simple message service".) However, the implemented port addressing scheme allows short messages to the remote control unit to bypass standard cellular telephone functions and to operate the features of the unit independently. The desired port to be addressed on the receiving unit is configured in the user data header of the SMS message that is transmitted to the receiving unit as is well known in the art. Further, the various remote control units can send SMS information to and from one another, exclusive of the base control unit in order to change the status information for a particular user. For example, if one remote control unit desires to be inactive, a command is sent to the other remote control unit to change the personal status thereof as displayed on the other units. Similarly, the remote control units can send SMS messages to the applications running in the other remote control units to affect operation parameters of those receiving remote control units.

By way of illustration, if the base control unit notifies the remote control unit of an activation of an alarm system associated with the base control unit, the remote control unit receives textual messages and graphical indicators to alert the user. The user acknowledges receipt of the alert by pressing a button or entering a code. The communication does not involve the voice mode for communicating between the two units. Use of a conventional programmable cellular telephone readily meets the regulatory requirement that a device that participates in the cellular network be FCC or CTIA approved.

SMS port addressing allows Mobile Terminated SMS messages to be processed within the cellular telephone's application software without user intervention. Such uses include Voice Mail notifications, Wireless Access Protocol WAP, E-mail, and Phone Provisioning. The Internet Assigned Numbers Authority (<http://www.iana.com>) is responsible for defining the use of the various ports and specific ranges of numbers have been assigned for use by application software.

When the Java software application is operationally accessed by microcontroller **45** and started within the remote control unit **12**, it attaches itself to a specific port for the reception of SMS messages. All Mobile Terminated (MT) SMS messages that contain a User Data Header (UDH) that indicate a port address, such as 50120, will be forwarded to the application software for processing.

The following AT command sequence is illustrative of the commands the base station unit **16** sends to the wireless module **70** over serial communications interface **110** to send a message to the remote control unit **12** to notify it that the temperature in zone 0 is currently 72 degrees:

```
ATE=0\r Turn off echoing of characters sent to the module
AT+CMGF=0\r Set Module in PDU Message format
AT+CMGS=44\r Total length of PDU is 44 octets
0041000AC10294268088000023060504C3C800003C7-
10 AB90D07E9DFEE724F041381EC6176BDDC-
13DD64A2970F <ctrl-Z>
```

The base control unit **16** is configured to interact with and respond to multiple remote control units **12**. If multiple remote control units **12**, or associate units **26** are deployed, one of the remote control units could be considered a master and all others could be considered slaves. Specific operational characteristics of the base control unit **16** may be configured as to only respond to commands from the master remote control unit. Alternatively, the remote control units may be segregated into classes such that the base control unit responds to commands and communicates selected information to a class containing one or more remote control units. An example would be a first class consisting of remote control units operated by parents and a second class consisting of remote control units operated by children. Information pertaining to the activities of the children may be selectively reported by the base control unit to the parents. By way of illustration, when a child operating a remote control unit in the second class disarms the alarm system prior to entering the residence controlled by the base control unit, parents in the parent class are notified accordingly that the child has arrived at home. The class assignments and configurations are easily customized to provide the notifications desired by the authoritative system operators, in this case, the parents.

The GPS receiver module **64** including antenna **65** is optionally incorporated into the remote control unit **12** for allowing the remote control unit to communicate position information to the base control unit **16**. The GPS may also be incorporated into wireless module **56**, as in newer CDMA 2000 compatible cellular modules. This feature allows the base control unit to change its operational characteristics based upon the location of the remote control unit(s).

For example, the base control unit may adjust the water temperature and thermostats when one of the remote control units comes within a specific distance from the house. The geographic information that is acquired by the GPS subsystem in the remote control unit (whether it is a separate GPS unit or part of the module) can be compared to settings stored in either the remote control unit itself or the base control unit to provide capabilities such as Geo-Fencing, Asset Tracking, and Bio-Location (knowing where a living entity is located).

In the preferred embodiment, the position data are derived from NEMA data received from the GPS component. NEMA data includes latitude, longitude, time, velocity, and heading information. Each information packet is streamed once per second. Data are captured by the remote control unit, they are processed by its application software, and the results are transmitted by port-addressed SMS to the base control unit for proximity detection. Specific remote control units can be configured in such a way that they send a status message to the base control unit if they exceed a programmed set of boundary conditions. If desired, the base control unit can on its own initiative query the remote control unit to learn its geographic location.

Geographic location information is programmed into the base control unit through keypad **120**. Additionally, the geographic location of the base control unit may be entered into a GPS-enabled remote control unit through the application software user interface. A user-determined distance is then programmed into the remote control unit. When the remote control unit travels a distance that exceeds the programmed distance from the base control unit, the remote control unit reports this information to the base control unit. The base control unit will then send this information to the appropriate user or to a predetermined class of users. This is an example of geo-fencing and would be typically used to notify parents that one of their children has traveled beyond a set distance from the home.

The base control unit communicates status information to the remote control unit either on a periodic or event-driven basis. It can initiate communications based on its aggregated inputs, or it can respond to individual requests and commands received from the remote control unit.

Examples of events that could cause the base control unit to initiate a communications session with the remote control unit include fire or burglar alarm activation, HVAC or freezer temperature thresholds exceeded, equipment failures, an air filter change necessary, a change in the home state vector, (occupied, unoccupied) or a geographical boundary condition exceeded by one of the other remote control units.

In addition to communicating status information to the remote control unit, the base control unit will, as programmed, initiate corrective action for the indicated event. For example, upon communicating an alarm activation message to a remote control unit, the base control unit, upon detecting the presence of an authorized user arriving at the local location, could disable the alarm system. Upon the detection of a member of an authorized class member, the base control unit can start the operation of the whirlpool bath in anticipation of the user's arrival, turn on specified interior and exterior lighting, or increase or decrease the thermostat set point for the heater or air conditioner.

Yet additional geographical dependent operation or control may be provided by the inherent aspects of Bluetooth wireless technology presently available from a wide variety of professional and consumer electronic equipment manufacturers and vendors. Bluetooth radio-frequency protocol enabled devices allow totally wireless operation of devices such as computers, computer keyboards, printers, pointing devices, digital audio players, headphones, computer games, personal digital assistants, remote controls, and the like. Each Bluetooth device is characterized by one of three power classes: Class 1 is designed for long range (approximately 100 m) devices, with a maximum output power of 20 dBm; Class 2 is for ordinary range devices (approximately 10 m) devices, with a maximum output power of 4 dBm; and Class 3 is for short range devices (approximately 10 cm) devices, with a maximum output power of 0 dBm. Class 2 devices are used in the preferred embodiment as they provide a beneficially sized geographic range or fence around the local location to allow the system to provide presence detection functionality.

Each chipset in a Bluetooth enabled device has a unique serial or identification number. To enable the base control unit to recognize and respond to the presence of a Bluetooth enabled device, the device must be physically held within operable range of the control unit. The user instructs the control unit to request authorization from the Bluetooth device. An authorization code is manually entered into the base control unit and then into Bluetooth device. If the

unique identification or serial number entered into each unit matches, it is stored and associated with the particular user or class of users, and the base control unit and the Bluetooth enable device are authenticated and are in communication with each other. At a periodic interval, the base control unit directs the Bluetooth master unit (located in the base control unit) to do a device discovery and report back the unique identification numbers it finds. If an identification number is not discovered, the user is assumed not within close proximity of the base control unit, which then reports the results to the designated class of users. If desired or necessary based on environmental circumstances, the Bluetooth receiver can be remotely located from the base control unit for controlled reception or to compensate for radio frequency coverage problems. The Bluetooth enabled device could be a cellular telephone, a watch, an MP3 player, a pendant, or any other Bluetooth equipped device compatible with current Bluetooth standards.

In the preferred embodiment, the Bluetooth enabled remote control unit may be programmed using Java J2ME to send a message to other remote control units when they detect a specific base station control units. This feature allows multiple base station control units in a large environment and the case that the remote control unit handles the notification.

While the preferred embodiment employs popular Bluetooth technology, it should be appreciated and understood that other presently available technologies, such as 802.11 (x), or future technologies can be used in the same manner as Bluetooth. The base control and remote control units each contain application software that is readily modifiable to adapt to a new or different technology or protocol.

Application software within the systems microcontroller **106** provides for autonomous control that is either preprogrammed at the time of manufacture or customized by the end user of the base station for their specific needs. Examples of autonomous control include: shut down of the air handling system if a fire is detected, thereby the spread of smoke and the possibility of "fanning" the fire; adjusting of indoor temperature and humidity settings depending upon conditions and information such as outdoor environmental conditions such as temperature, humidity, sun load and wind, short-term weather forecasts, family schedule and activities, structure occupancy, context, location of users; shutdown of sensitive electronic components and subsystems in cases of severe weather, or failures in other subsystems; closing and opening of windows and/or window coverings to conserve energy; control of sprinkler systems based upon current weather conditions and weather forecasts. The application software includes a macro language interpreter to enable efficient end-user customization and future expansion to the system. A macro is a miniature computer program activated by a symbol, name, or key that represents a list of commands, actions, or keystrokes. A macro allows a local or remote user to enter a single character or word to perform a series of predetermined actions.

Base control unit **16** further comprises the Ethernet interface **82** to respond to external web services generally accessible through an Internet connection. For example, at present, weather services on the Internet can be queried using the SOAP protocol. The services respond with timely weather information, typically encoded in XML. The base control unit **16** understands and interprets that received information and responds according to instructions, including macros, programmed into its application software. Such capability allows the base control unit to take actions, like

causing the sprinkler system to bypass its scheduled watering cycle should rain be forecast. Other information services allow other responses. A school system's notification that schools are being released early due to inclement weather conditions could cause the base control unit to notify the class containing the parental remote control users of the decision to afford the parent the opportunity to make transportation and custodial decisions with regard to their children in the schools. The application software is RSS-aware and is capable of receiving and responding accordingly to RSS feeds. RSS ("really simple syndication") is an efficient and popular web content syndication serial data format. Any information that can be broken down into discrete data items can be syndicated via RSS. Once information about each item is in RSS format, in the present invention, the base control unit examines the feed for changes and reacts to the changes in an appropriate way. The Ethernet bridge function is easily updated and expanded by an upload of revised application software to the base control unit.

Messages from the remote control unit **12** to the base control unit **16** do not need to rely on port addressing for processing. The base control unit **16** uses a cellular telephone module that does not contain a user interface. The processing of SMS messages is handled by the base control unit applications software.

The base control unit **16** commands the cellular module to send newly received SMS messages directly to the base control unit **16** over the serial port using unsolicited result codes. Upon receipt of a new message the cellular module sends the following:

+CMT: <length> <CR> <LF> <pdu>

Where <length> is the length of the <pdu> element <CR> is carriage return and <LF> is line feed. <pdu> is the Short Message data in either PDU or text format.

The base control unit **16** processes the data according to the content of the message data.

Although port addressing is not currently used when messages are sent from the remote control unit **12** to the base control unit **16** software (it still is used within the base control unit **16** cellular module for provisioning and control from the carriers), the system can utilize the port addressing to direct messages to specific subsystems that are tied to the base control unit **16**.

The present invention thus provides an on-demand bidirectional communications interface for monitoring, controlling, and securing various environment functions and characteristics attendant the interior and exterior of a building. The system may thus monitor and control temperature, and a myriad of other environmental functions of the building include, by way of example and not limitation, temperature, power status for the building and discrete applications therein, humidity/moisture, smoke/toxic gases, structural breaches, security status, visual conditions and a host of other natural and non-natural phenomena.

The base control unit is preferably mounted at an appropriate location on a wall within the building to provide a local access for regulation. The base control unit is locally operatively interfaced with a plurality of sensors and devices systematically distributed throughout the building and communicating according to varying protocols such as infrared, radio frequency, X-10, and hard wiring.

The sensors provide continuous measurement and status of target environmental characteristics. Examples of sensor applications include utilities status, moisture and humidity detection, door and window condition, and the like. Asso-

ciated controlled devices providing operational functions refrigeration, water heating, security cameras, illumination devices, and the like.

The air handling unit receives signals from the associated sensors and communicates them to the base control unit **16** that, based on the processed measured characteristics thereof, activates or deactivates one or more of the devices of the unit in response to the measurement. For example, if the temperature sensor exceeds a preset value, the HVAC unit is activated, and when the measured characteristic is within a preset value range, the unit is deactivated. In addition, when a measured characteristic exceeds a predetermined value range, an alarm signal may be transmitted to a remote control unit **14** to provide an audible, tactile, and/or visual indication. Thus, if utility sensor **S2** indicates a loss of electrical, water, or communications service, a signal is sent to the remote control unit **14** and the operator thereof has the ability to take corrective action in response thereto. Also, the operator may invoke the a command from the remote control unit **14** to the base control unit **16** to activate a select device such as the HVAC unit, a water heater, a refrigeration appliance or other discrete device remotely in order to prepare the building for occupancy by the operator or designee.

The sensors for the system are distributed throughout the building to detect the environmental characteristics of the building. These characteristics include, but are not limited to, temperature, humidity/moisture, smoke/toxic gases, structural breaches, and a host of other natural and non-natural phenomena.

In a conventional thermostat, a temperature sensor and switch automatically control a heating or cooling appliance when the sensed temperature is beyond a preset value. The thermostatic interface of the invention would include a temperature sensor that constantly monitors the environmental temperature and control of a heating and/or cooling appliance to maintain the building at a substantially constant temperature.

The thermostatic interface also receives other environmental characteristics of the building and responds in a like manner. For example, a sensor would monitor the humidity (or moisture content of the air) of the building. If the temperature monitored by temperature sensor is within the preset range value, a conventional thermostat would not adjust the heating and/or cooling appliance to regulate the moisture content, thus presenting favorable environment for the growth on molds and mildew. The thermostatic interface receives the humidity value measured by the humidity sensor, determines that the value exceeds a predefined limit, and generates an alarm signal that is transmitted as an alarm signal via the communication link to the remote control unit. The operator receives the information and transmits a control signal from the remote access unit to the base control unit via the communication link and activates the appropriate appliance in response thereto, thus reducing the humidity value to acceptable levels and preventing the progression of mold and mildew growth.

The sensors are distributed according to a predetermined plan that effectively makes the "most likely place" for a change in environmental characteristics to be sensed. For example, several smoke/toxic gas sensors would be distributed about the ceilings and floors so as to identify the presence of smoke (i.e. fire) or carbon monoxide (i.e. toxic gas), and relaying the measured characteristic to the thermostat. Other types of sensors would be optimally placed in order to monitor the egression of water into the building, lighting striking the building, suspension or cessation of a

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provided utility (i.e., electric power, water and sewer provisions, natural gas), collapse of the building or a portion thereof due to weather (i.e., tornado, hurricane, blizzard), or breach of the building security (i.e., break-ins). The sensors may be hard wired through the structure of the building. 5 Also, the sensors may have a wireless communication. The optimal presentation would be a dual connection, such as a hard-wired and wireless communication, e.g., a transmitter/receiver. This provides maximum effective monitoring of the building because the hard wiring would alleviate the need for constant battery monitoring, likewise, the wireless communication provides monitoring should the absence of electrical power be a factor. For example, the combined hard wired and wireless connection of the sensors to the unit allows the monitoring of the building and generates the alarm when the power is lost due to an area wide electrical outage. The unit transmits that information (i.e., the loss of electrical power) to the remote control unit and the operator is aware that the electrical power is absent. If the loss of electrical power were due to a nefarious figure seeking to breach the building, i.e., breaking a window to gain access, a security sensor would still be able to provide the base control unit with an indication that the building has a security breach. The base control unit, operating under an alternate electrical power supply such as a backup battery, would generate a subsequent alarm signal and transmit the subsequent alarm signal for routing through the direct connect wireless for immediate transmission to the remote control unit, thereby alerting the operator that in addition to the loss of electrical power, the security of the building has been breached. The operator can thereby contact the law enforcement facility of the local jurisdiction and have an immediate response. If the remote control units are organized in classes, such as "managers", the information would be almost simultaneously provided to each member of the class who would have a need to receive and react to it. 15 20 25 30 35

In addition to main residence use, the system is typically suited for a vacation/second dwelling, a business concern, or any building structure that is not constantly occupied. For example, if the thermostat control system is installed in a vacation home in one locality, the operator may effectively be in any other portion of the globe so long as an effective communication link is provided with the remote control unit 14. 40

Multiple base station units could be controlled through a single cellular phone for those instances where a person desires to have systems installed in multiple residences. The application software uses the Source Address field of the message to distinguish between different base control units 16. 45

It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims. 50

What is claimed:

1. A base unit configured to communicate with an environmental device and to communicate with a cellular remote unit having wireless connectivity capable of communicating from a geographically remote location, the base unit comprising: 60

a first communication interface configured to receive environmental information from the environmental device and to send a control instruction to the environmental device;

a wireless communication interface configured to send a first message to the cellular remote unit via a cellular 65

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communications network and to receive a second message from the cellular remote unit via the cellular communications network, wherein the first message is a first digital communications message including a representation of the environmental information, and wherein the second message is a second digital communications message including a command regarding the environmental device; and a microcontroller configured to process the second message, to provide the control instruction based on the command, and to send the control instruction to the environmental device via the first communication interface, and wherein the command is for the base unit initiated by a user from the cellular remote unit, and wherein the control instruction to the environmental device is associated with the command for the base unit, wherein the cellular remote unit is configured to determine position data of the cellular remote unit, and determine when the cellular remote unit is outside a geo-fence, wherein the cellular remote unit is configured to transmit a notification via a simple message service responsive to determining that the cellular remote unit is outside of the geo-fence. 2. The base unit of claim 1, wherein the command regards entering an energy conservation mode, and wherein the energy conservation mode is associated with multiple environmental devices. 3. The base unit of claim 1, wherein the command is associated with an icon on the remote unit. 4. The base unit of claim 1, wherein the control instruction is configured to adjust a temperature of a water heater. 5. The base unit of claim 1, wherein the control instruction is configured to adjust an air handling system. 6. The base unit of claim 1, wherein the cellular communications network includes a data bearer service. 7. The base unit of claim 1, wherein the remote unit is a mobile remote unit. 8. The base unit of claim 1, wherein the control instruction includes an environmental control instruction; and wherein the command includes an environmental command. 9. The base unit of claim 1, wherein the command is an energy conservation command associated with multiple environmental devices. 10. The base unit of claim 1, wherein the cellular communications network includes a data bearer service; wherein the remote unit is a mobile remote unit; wherein the control instruction includes an environmental control instruction; and wherein the command includes an environmental command. 11. The base unit of claim 10, wherein the second message includes an energy conservation command associated with multiple environmental devices. 12. The base unit of claim 10, wherein the microcontroller is configured to process the environmental information into the representation and to process the command into the control instruction. 13. The base unit of claim 1, wherein the remote unit is a cellular telephone, and wherein the environmental device comprises a thermostat. 14. The base unit of claim 1, wherein the environmental device comprises at least one of a light, thermostat, or an alarm system. 55 60 65

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15. The base unit of claim 1, wherein the base unit and the environmental device are contained in the same enclosure.

16. The base unit of claim 1, wherein the cellular communications network includes a simple message service.

17. The base unit of claim 1, wherein the cellular remote unit is configured to determine when the remote control unit is within a geo-fence.

18. The base unit of claim 1, wherein the base unit is configured to receive data from an external web service, and responsive to receiving the data the base unit sends the control instruction.

19. The base unit of claim 18, wherein the external web service is a weather service.

20. The base unit of claim 1, wherein the command includes cellular data.

21. The base unit of claim 1, wherein the command is initiated by a user from the cellular remote unit responsive to the user interacting with an icon on the remote control unit associated with the environmental device.

22. The base unit of claim 1, wherein the base unit comprises a cellular module configured to communicate data over the cellular communications network.

23. The base unit of claim 1 wherein the microcontroller is configured to send status information to the cellular remote unit on a periodic basis.

24. A base unit configured to communicate with an environmental device and to communicate with a remote unit having wireless connectivity, the base unit comprising:

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a first communication interface configured to receive environmental information from the environmental device and to send a control instruction to the environmental device;

a wireless communication interface configured to send a first message to the remote unit via a communications network and to receive a second message from the remote unit via the communications network,

wherein the first message is a first digital communications message including a representation of the environmental information, and

wherein the second message is a second digital communications message including a command regarding the environmental device; and

a microcontroller configured to process the second message and to send the control instruction based on the command via the first communication interface to the environmental device, and

wherein the wireless communication interface is configured to send a third message to a subordinate remote unit via the communications network and to receive a fourth message from the subordinate remote unit via the communications network,

wherein the fourth message includes a subordinate command to the environmental device, and wherein the microcontroller is configured to process the fourth message and to send selectively a second control instruction based on the subordinate command via the first communication interface to the environmental device.

* * * * *

EXHIBIT C

11/686,993

**UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR
REMOTE LOCATIONS**

P2921569

06-27-
2018::18:48:10**Patent Assignment Abstract of Title****Total Assignments: 3**

Application #: 11686993 **Filing Dt:** 03/16/2007 **Patent #:** 8064935 **Issue Dt:** 11/22/2011
PCT #: NONE **Intl Reg #:** **Publication #:** US20070167179 **Pub Dt:** 07/19/2007
Inventors: Charles G. SHAMOON, Deborah H. SHAMOON, Franklin Eugene NEAL, Michael FEHNEL
Title: UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR REMOTE LOCATIONS

Assignment: 1

Reel/Frame: 020951 / 0111 **Received:** 05/13/2008 **Recorded:** 05/12/2008 **Mailed:** 05/16/2008 **Pages:** 2
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignors: SHAMOON, CHARLES **Exec Dt:** 05/31/2006
SHAMOON, DEBORAH **Exec Dt:** 05/31/2006
Assignees: TURKOW, ALLEN
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Assignment: 2

Reel/Frame: 028125 / 0418 **Received:** 04/30/2012 **Recorded:** 04/30/2012 **Mailed:** 05/01/2012 **Pages:** 5
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignors: SHAMOON, CHARLES **Exec Dt:** 03/09/2012
SHAMOON, DEBORAH **Exec Dt:** 03/09/2012
Assignee: UBIQUITOUS CONNECTIVITY, LP
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RALEIGH, NC 27601

Assignment: 3

Reel/Frame: 028125 / 0242 **Received:** 04/30/2012 **Recorded:** 04/30/2012 **Mailed:** 05/01/2012 **Pages:** 5
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignors: TURKOW, ALLEN **Exec Dt:** 03/13/2012
TURKOW, LUCY **Exec Dt:** 03/13/2012
Assignee: UBIQUITOUS CONNECTIVITY, LP
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RALEIGH, NC 27601

Search Results as of: 06/27/2018 18:47:19 PM

Disclaimer:

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EXHIBIT D

13/271,203

**UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR
REMOTE LOCATIONS**

GSHAM.00101

06-27-
2018::18:49:54**Patent Assignment Abstract of Title****Total Assignments: 2****Application #:** 13271203**Filing Dt:** 10/11/2011**Patent #:** 9602655**Issue Dt:** 03/21/2017**PCT #:** NONE**Intl Reg #:****Publication #:** US20120094638**Pub Dt:** 04/19/2012**Inventors:** Charles G. Shamoan, Deborah H. Shamoan, Franklin Eugene Neal, Michael Fehnel**Title:** UBIQUITOUS CONNECTIVITY AND CONTROL SYSTEM FOR REMOTE LOCATIONS**Assignment: 1****Reel/Frame:** 028125 / 0418**Received:** 04/30/2012**Recorded:** 04/30/2012**Mailed:** 05/01/2012**Pages:** 5**Conveyance:** ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).**Assignors:** SHAMOON, CHARLES**Exec Dt:** 03/09/2012

SHAMOON, DEBORAH

Exec Dt: 03/09/2012**Assignee:** UBIQUITOUS CONNECTIVITY, LP

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RALEIGH, NC 27601

Assignment: 2**Reel/Frame:** 028125 / 0242**Received:** 04/30/2012**Recorded:** 04/30/2012**Mailed:** 05/01/2012**Pages:** 5**Conveyance:** ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).**Assignors:** TURKOW, ALLEN**Exec Dt:** 03/13/2012

TURKOW, LUCY

Exec Dt: 03/13/2012**Assignee:** UBIQUITOUS CONNECTIVITY, LP

2436 TISBURY WAY

LITTLE ELM, TEXAS 75068

Correspondent: ERIC P. STEVENS

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RALEIGH, NC 27601

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Disclaimer:**Assignment information on the assignment database reflects assignment documents that have been actually recorded.****If the assignment for a patent was not recorded, the name of the assignee on the patent application publication or patent may be different.****If you have any comments or questions concerning the data displayed, contact OPR / Assignments at 571-272-3350**[Close Window](#)

EXHIBIT E

TXU iThermostat



Set your savings to automatic.

Keep your home at just the right temperature no matter where you are with the TXU iThermostat™.

<p>Already Have an iThermostat?</p> <p>Access the Portal</p> <p>Or call 1-844-820-2914</p>	<p>Not a Customer Yet?</p> <p>Shop Plans & Get iThermostat></p>	<p>Already a Customer?</p> <p>Log in & Get iThermostat></p>
---	---	---



Control your comfort.

Set your iThermostat to the temperature you like and forget it. When you change your mind – or the weather changes it for you – simply use the iThermostat app to adjust the temperature. Be comfortable at home, and save energy and money while you're away.



Make a smarter home.

Set a schedule conveniently from your smartphone, online or the thermostat. You can toggle between heat and cold and set temperature holds. Program it to know when you're close to home so you can walk into comfort. Plus, your iThermostat tracks your usage and can help you use less and save more.



Access anytime, anywhere.

Adjust your thermostat whenever, wherever with the iThermostat app. You can also control it using simple voice commands with an Amazon Alexa-enabled device. Just open your Alexa app and search for the TXU iThermostat skill.

Download the app.



Leave a positive impact.

As an iThermostat customer, not only can you save money, but you can also help the environment by participating in the TXU Conservation Program.*

Not a Customer Yet?

Already a Customer?

*TXU iThermostat is available in eligible services areas for single-family homes with compatible central HVAC and high-speed Internet services. Requires 2-year agreement on TXU Conservation Program, which may include brief on/off cycling (10-15 minutes) of customer's air conditioner or modification to thermostat setpoints no more than four degrees higher than programmed settings (up to 1-4 hours) via remote signal from TXU Energy during periods of peak energy usage from May-September; customer may opt out of individual demand response events. Applicable monthly fee appears on your TXU Energy bill. See terms and conditions for details.

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EXHIBIT F



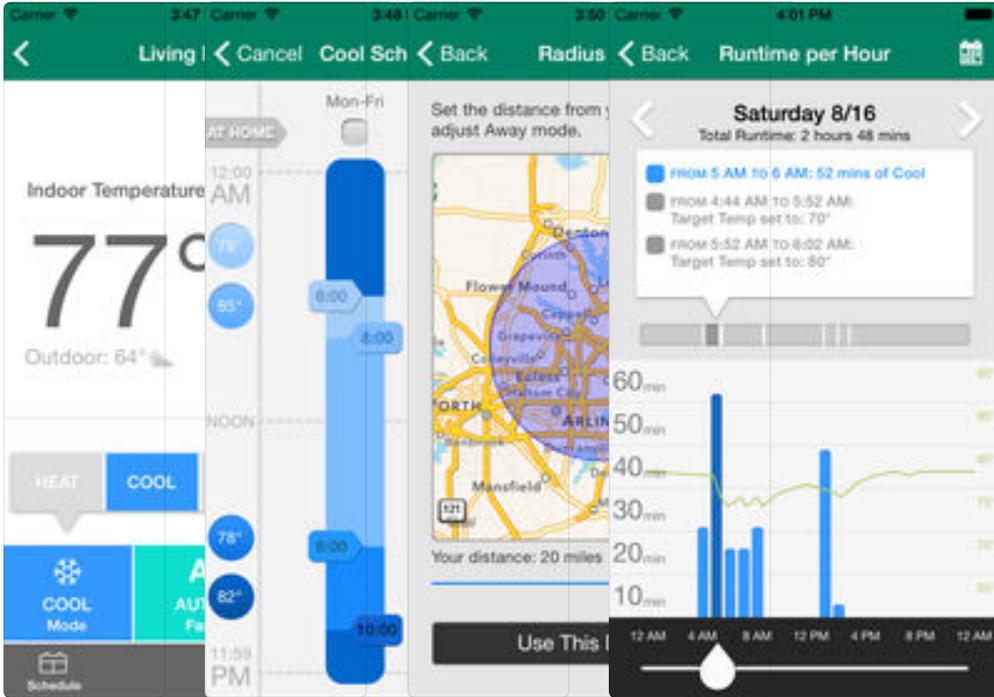
App Store Preview

This app is only available on the App Store for iOS devices.



TXU iThermostat™ 4+
TXU Energy Retail Company LLC
★★★★★ 2.5, 11 Ratings
Free

Screenshots iPhone iPad



Description

The TXU iThermostat™ app allows you to control your thermostat from your iPhone® or iPad®. No need to have to go to your actual thermostat again to set your schedule or change the temperature.

Now with location-based controls, you can program settings to start and stop your heating and cooling when you are close to your home or business based on your smartphone's GPS location. The TXU iThermostat™ app allows you to remotely adjust your thermostat's settings, or quickly put your entire home or business into energy saving "Away" mode with the tap of a button.

What's New

[Version History](#)

Version 1.4.2

- Additional bug fixes and improvements

Tip: Did you know you can update your schedule from the app? Tap the Schedule icon to make changes.

If you run into any issues, please contact support!

[more](#)

Ratings and Reviews

2.5

out of 5



11 Ratings

Quality Manager Oct 19, 2016
 ★☆☆☆☆ K. Chapman

I have had the TXU wifi thermostats from when they were first offered to me about five years ago. I really liked the system, the controls and graphics. This update however is a step backwards. I find it hard to use and...

[more](#)

tfree4ends Jul 22, 2017
 ★☆☆☆☆ Tfree3

I would be ok with this app, but the temperature is never the same on my iPhone as the thermostat in my house... always off by 2-3 points. This is frustrating and probably costing me more money.

Information

Seller	TXU Energy Retail Company LLC
Size	16.3 MB
Category	Utilities
Compatibility	Requires iOS 8.0 or later. Compatible with iPhone, iPad, and iPod touch.
Languages	English
Age Rating	Rated 4+
Copyright	© 2016
Price	Free

[Developer Website ↗](#)

[App Support ↗](#)

[Privacy Policy ↗](#)

Supports

 **Family Sharing**
 With Family Sharing set up, up to six family members can use this app.

More By This Developer



TXU Energy
Business

You May Also Like

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Energy Advisor
Utilities



DART Say Someth...
Utilities



Harris County Ap...
Utilities



My GPTX
Utilities

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United States

EXHIBIT G

Your session will end in 60 seconds, and you will be signed out. [Click here to extend your session.](#)

Support

Need additional help?

For customer support, please call 1-844-820-2914.

Website & Mobile Apps

- [Why should I set a heating and cooling schedule?](#)
- [What is ENERGY STAR®? Why should I follow its recommendations?](#)
- [I forgot the password used for my account. How do I recover it?](#)
- [What is the Target Temperature?](#)
- [Explain the four Modes. What's the difference between Heat, Cool, Auto, and Off?](#)
- [What are my Fan settings for?](#)
- [What does the Set Away button do?](#)
- [What does the Hold button do?](#)
- [How long does it take for changes I make on the website or mobile apps to take effect?](#)
- [What happens if my thermostat goes offline?](#)
- [How do I move a thermostat to a different user account?](#)
- [How do I share a thermostat with someone who has a different user account?](#)
- [Will I get notification if my thermostat drops offline?](#)
- [Can I use my smartphone to control my thermostat?](#)
- [I put my Thermostat in Auto mode. Why can't I change the Target Temperature?](#)
- [How can I change my thermostat units from Fahrenheit to Celsius?](#)
- [How do I change the email address associated with my existing TXU iThermostat account?](#)
- [What are Temperature Alerts?](#)
- [What is HVAC Runtime?](#)
- [Can I download my Runtime data?](#)
- [What is Radius™?](#)
- [How does Radius work?](#)
- [With Radius, can I use multiple devices?](#)
- [Can I remove a device from Radius?](#)
- [If I'm using Radius on multiple devices, can I override one of them?](#)
- [Can someone visiting my home override Radius?](#)
- [What devices are compatible with Radius?](#)
- [Why is my runtime data unavailable?](#)
- [How do I set up a Filter Alert on the TXU iThermostat?](#)

Website & Mobile Apps

[Back to Top](#) Why should I set a heating and cooling schedule?

Setting a schedule saves you money and energy. Many people fail to set heating and cooling schedules because their thermostats are just too difficult to operate. Your account, by contrast, offers an intuitive interface that makes setting your schedule a breeze.

[Back to Top](#) What is ENERGY STAR®? Why should I follow its recommendations?

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. The program's purpose is to help us save money and protect the environment

through energy efficient products and practices.

With the help of ENERGY STAR, Americans saved enough energy in 2010 alone to avoid greenhouse gas emissions equivalent to those from 33 million cars – all while saving nearly \$18 billion on their utility bills.*

*source: energystar.gov

[Back to Top](#)I forgot the password used for my account. How do I recover it?

Visit the [Reset Password](#) page. We'll email you a special link that will allow you to change your password. The link is only valid for 24 hours.

[Back to Top](#)What is the Target Temperature?

It's the temperature your thermostat will keep your home at or near. If your home is in cooling mode, your cooling system will turn on if the temperature in your home rises above the target. If your home is in heating mode, your heating system will turn on if the temperature in your home falls *below* the target.

[Back to Top](#)Explain the four Modes. What's the difference between Heat, Cool, Auto, and Off?

If your home is in **Cool** mode, your cooling system will turn on if the temperature in your home rises above the target. Cool mode is best for the summer months, when there's no chance you'll want your heat system activated. Due to the liquid in the compressor coils, avoid running the AC during cold temperatures to prevent the liquid from freezing. *To protect your cooling equipment from possible damage, do not use Cool mode when the outdoor temperature is below 50°F/10°C.*

If your home is in **Heat** mode, your heating system will turn on if the temperature in your home falls below the target. Heat mode is best for the winter months, when there's no chance you'll want your cool system activated.

If your home is in **Auto** mode, heating or cooling modes will be automatically activated within the range of your heating and cooling schedules. Auto mode is for shoulder seasons and should not be used during full heating or cooling season. Due to the liquid in the compressor coils, avoid using Auto mode during cold temperatures to prevent the liquid from freezing. *To protect your cooling equipment from possible damage, do not use Auto mode when the outdoor temperature is below 50°F/10°C.*

If your home is in **Off** mode, you are not using your HVAC system to control your home's temperature.

[Back to Top](#)What are my Fan settings for?

When your fan is set to Auto, it remains off until needed to circulate warm or cool air through your home. When your fan is set to On, it runs continuously, even if your HVAC system is not actively heating or cooling your home. Setting your fan to Auto is the more energy-efficient choice.

[Back to Top](#)What does the Set Away button do?

Clicking on Set Away is an easy and convenient way to set your home to an energy-efficient temperature while you're away. Going back to your normal schedule is just as easy – click End Away when you return. You can change the thermostat's Away temperature on the Settings tab of the Thermostat page.

[Back to Top](#)What does the Hold button do?

The Hold button maintains your home at its current target temperature even if a schedule change should occur. It's there in case you deviate from your usual routine – you're throwing a party in your home, for

example, and don't want your home to shift into its overnight temperature setting. You can find the Hold button on the thermostat's Schedule tab on the Thermostat page.

But don't just set your thermostat to Hold and leave it there! You'll miss out on the savings and efficiency only a schedule can provide. Use the End Hold button on the thermostat's Temperature or Schedule tab on the Thermostat page to resume your normal schedule.

[Back to Top](#)How long does it take for changes I make on the website or mobile apps to take effect?

Changes you make to your thermostat settings from the website and mobile apps will generally be applied within one minute. Occasionally, it can take a few minutes to be applied to your thermostat due to network congestion or delays. Customers using a Lux iThermostat on battery power alone may experience a longer delay.

[Back to Top](#)What happens if my thermostat goes offline?

Your thermostat will maintain the schedule you've set even when it's not connected to the internet. To restore your thermostat connection:

For customers with a Carrier TXU iThermostat

1. Check your thermostat power.
Touch the screen to wake up the thermostat. If, after tapping the screen, it's still blank then your thermostat doesn't have power. Check the breaker for the HVAC system in the electrical panel to ensure it's in the "ON" position and not "OFF" or tripped. If power is still not restored, contact your HVAC contractor to have power restored to the HVAC system or us at 1-844-820-2914 to assist with additional troubleshooting steps.
2. Confirm your gateway has power and is connected to your router.
The gateway device connected to your router will have three green lights illuminated. If these lights are not illuminated please check that the device has power and the ethernet cable is connected to your router. If the lights are illuminated try power cycling the gateway by unplugging it for a minute, then plugging it back in. If, after a few minutes, the lights don't illuminate, then continue to step four.
3. Check your thermostat's connection.
If your thermostat is connected to the gateway you'll see a signal strength indicator on the top right of the thermostat screen. If there is no signal indicator, then continue to step below.
4. Reset your router.
Resetting or restarting your router will often clear up connection problems.

If you still need assistance, call us at 1-844-820-2914. We're always here to help.

For customers with a Lux TXU iThermostat

1. Check your thermostat power.
If the thermostat screen is blank, then your thermostat doesn't have power. Confirm that your thermostat is powered by batteries, C ("common") wire, or micro USB power adapter. If it's batteries, remove your thermostat from the wall and replace the batteries.

If your thermostat still doesn't have power, check the breaker for the HVAC system in the electrical panel to ensure that it's in the "ON" position and not "OFF" or tripped. If power is still not restored, contact your HVAC contractor to have power restored to the HVAC system or call us at 1-844-820-2914 to assist with additional troubleshooting steps.

2. Check your router
Confirm your wireless router is working and you have access to the internet. If your internet connection or router is down, your thermostat will reconnect automatically when your internet

connection is restored. Resetting or restarting your router will often clear up connection problems. If your thermostat is not connecting to the internet, then continue to the step four.

3. Confirm your thermostat is connected to your router.

If your thermostat is connected to your wireless router, you'll see a radio wave icon on the upper right hand corner of the screen. If there is no signal indicator, then continue to the step below.

4. Reset your thermostat.

Remove the thermostat from the wall. The RESET button is on the back of the thermostat. Press and hold the RESET button for three seconds until the screen resets. Once reset, replace the thermostat on the wall. After the thermostat has connected to your router, it will display a radio wave icon on the upper right hand corner of the screen.

If you still need assistance, call us at 1-844-820-2914. We're always here to help.

[Back to Top](#)How do I move a thermostat to a different user account?

The easiest way to move a thermostat to a different user account is to share the thermostat. See the question ["How do I share a thermostat with someone who has a different user account?"](#)

[Back to Top](#)How do I share a thermostat with someone who has a different user account?

You can share thermostat control with friends and family without sharing your password. Navigate to the Locations tab on your Profile. Select the "share location" link for the location you want to share. Now just enter the other person's email address, and they'll get an invitation to share access to the thermostats in that location.

[Back to Top](#)Will I get notification if my thermostat drops offline?

Yes, you'll get an automatic email notification when your thermostat has been offline for 24 hours without connecting. You can change your notification preferences for a thermostat on the Settings tab of the Thermostat within the TXU iThermostat Customer Portal website.

[Back to Top](#)Can I use my smartphone to control my thermostat?

Yes, currently we have mobile apps available for [iOS \(iPhone, iPad, iPod touch\)](#) and [Android](#). Both apps allow you to manage your thermostat when you're on the go.

[Back to Top](#)I put my Thermostat in Auto mode. Why can't I change the Target Temperature?

If your thermostat is in Auto mode Heat or Cool modes will be automatically activated within the range of your heating and cooling schedules. You may notice that on the website and mobile apps you can't make any temporary changes to the current Target Temperature. In addition you won't see the current Target Temperatures for Heating and Cooling.

Currently those options are not available. To make a temporary Target Temperature change please select Heat or Cool mode, then choose a new Target Temperature.

[Back to Top](#)How can I change my thermostat units from Fahrenheit to Celsius?

The units used on the website and mobile applications can be changed by logging into the TXU iThermostat Customer Portal website or TXU iThermostat app and editing your profile. On the profile page you can change your Temperature Preference. This change will be applied to the website and mobile applications.

[Back to Top](#)How do I change the email address associated with my existing TXU iThermostat account?

Sign in to your account on the TXU iThermostat Customer Portal website. Once signed in to your account, click on your name in the top right corner of the screen and select "Account Info." Here you'll be able to change the email address associated with your iThermostat account only. Remember to contact TXU Energy if you need to update the email address tied to your electricity account. NOTE: You'll only be able to set your email address to one that has never been used to create a TXU iThermostat account. If you're looking to move your thermostats to another existing TXU iThermostat account, please see the question about moving thermostats. "How do I move a thermostat to a different user account?"

[Back to Top](#)What are Temperature Alerts?

Temperature Alerts send you an email when the temperature in your home falls outside a range you set. For example, you can ask to receive an email if the temperature inside your home falls below 50 °F. In this example, you will also receive an email once an hour until the temperature inside your home goes above 50 °F.

[Back to Top](#)What is HVAC Runtime?

With HVAC Runtime, you can monitor your HVAC system's performance. Find out just how much your heating and cooling system is running each day and why. Review historical data on the TXU iThermostat Customer Portal website or your mobile device.

[Back to Top](#)Can I download my Runtime data?

Yes, you can download the data on the TXU iThermostat Customer Portal website. Click the "Download last 30 days" button.

[Back to Top](#)What is Radius™?

Radius helps you save money and energy by automatically setting Away when your mobile device leaves an area that you define (a set distance around your location address). NOTE: This feature is currently available on iPhone and Android devices with location support.

[Back to Top](#)How does Radius work?

Radius uses the location services built into your device to determine when you've left your location and turns on Away for your thermostat(s). For example, let's say you set a 5 mile radius. Once you've gone 5 miles from your home in any direction, Away mode will activate. On your way home, once you get within 5 miles, the app will turn Away mode off, and your normal schedule will resume.

[Back to Top](#)With Radius, can I use multiple devices?

Yes, if your household has more than one supported device (currently available for iPhone and Android devices with location support) you can register each of these devices. Tap the Radius icon, then tap Update Devices to see which devices have been set up for Radius. A maximum of four devices is recommended.

[Back to Top](#)Can I remove a device from Radius?

Yes, tap the Radius icon, then tap Update Devices to see which devices have been set up for Radius. From this screen you can remove devices. In particular you may want to remove any devices you no longer own or want to control with Radius.

[Back to Top](#)If I'm using Radius on multiple devices, can I override one of them?

Yes, you can override the Away or Home status of one of your devices. Tap the Radius icon, and then tap Update Devices. Tap the device you'd like to override to make a change.

[Back to Top](#) Can someone visiting my home override Radius?

If someone in the home manually adjusts the thermostat, Away mode will end, and your schedule will resume.

[Back to Top](#) What devices are compatible with Radius?

Radius is compatible with iPhone 4 and later generations of iPhone devices with location services turned on and OS 4.3 or higher. Radius is not compatible with the iPad. Radius is also compatible with Android devices with location services enabled.

[Back to Top](#) Why is my runtime data unavailable?

Your thermostat collects data about when your heating or air conditioning system is operating. This data, called runtime, may not be reported due to the thermostat being offline, having a weak connection, or other thermostat errors. The most common reason your data may be missing is because your thermostat is currently offline or was offline during the time period being reviewed. For more information please see "[What happens if my thermostat goes offline?](#)"

[Back to Top](#) How do I set up a Filter Alert on the TXU iThermostat?

For customers with a Carrier TXU iThermostat

From the Home Screen, press the SETUP button on the touch screen, then press Reminders. Reminders button will display system runtime minutes remaining until recommended filter change. This screen allows you to reset filter reminder. Note: a FILTER button will appear on the Home Screen when the minutes remaining reach 0.

For customers with a Lux TXU iThermostat

From the MENU Screen, select FAN by using the dial and press up on the blue arrow, then select FILTER and press up on the blue arrow to reset the number of days until the next filter change. Use the dial to select the number of days in increments of 5. Once the desired number of days is selected, press up on the blue arrow to save your reminder and return to the Home Screen. Note: a FILTER Reminder icon will display in the upper right-hand corner when the days remaining reach 0.

- [Privacy Policy](#)
- [Terms of Use](#)
- [iPhone App](#)
- [Android App](#)
- [Powered by EnergyHub](#)

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EXHIBIT H



Personal Reference Guide
Brighten® iThermostat

Welcome to your new Brighten® iThermostat



Thank you for participating in the Brighten® Conservation Program and for helping us efficiently manage Texas' energy resources. You've made the smart choice to replace your old thermostat with an easy-to-use and fully Web-enabled Brighten® iThermostat, designed to help you control the biggest user of electricity in your home – your air conditioning and heating system. This guide includes information to assist you in setting up and maintaining your thermostat settings from the thermostat as well as from the Web portal.

To optimize your new thermostat's functionality, please remember to keep your gateway installed and powered at all times. If you have any questions or need further information regarding the Brighten® Conservation Program or your Brighten® iThermostat, please call 1-866-733-1807.

Thanks again for joining the Brighten® Conservation Program.

About the Brighten® Conservation Program

Your participation in the Brighten® Conservation Program and using the Brighten® iThermostat can help the environment by allowing TXU Energy to briefly cycle your air conditioner on and off during peak demand periods. Reducing peak demand helps by reducing: 1) the need for less-efficient generation, which costs more to operate; 2) the need for building new generation facilities; and 3) the strain on transmission facilities.

Thermostat Guide

Touch Screen Display

Active Home Screen – Activated whenever the screen is touched or the Home button is pressed.



Inactive Screen – Provides a clean, uncluttered look. Screen will return to the Inactive mode after 60 seconds.



- ① **Home Button** – Used to activate Home Screen, return to Inactive Screen or to return to Home Screen from any other screen.
- ② **Up and Down Buttons** – Used to increase or decrease settings, such as temperature and date/time values.

Home Screen Display

- ① Current room temperature.
- ② Period/hold – displays current programming period or if system is in a hold.
- ③ Date and time.
- ④ Signal strength indicator – indicates relative signal strength to gateway. Displays up to five solid gray bars when the signal is strong. Five empty red bars indicate loss of communication.
- ⑤ Status bar – displays current system settings.
- ⑥ **MODE** – Allows you to change your system mode:
 - **OFF** – Turns the heating and cooling system off.
 - **HEAT** – Enables heating equipment to operate as needed.
 - **COOL** – Enables cooling equipment to operate as needed.
 - **AUTO** – Enables both heating and cooling equipment to operate as needed.
- ⑦ **FAN** – Controls your system's indoor fan:
 - **AUTO** – The fan runs only when the heating or cooling system is running.
 - **ON** – The fan runs continuously regardless of whether the heating or cooling system is running.



- ⑧ **HOLD/RESUME** – Sets and cancels temperature holds:
 - Select **HOLD** to hold temperatures displayed above **HEAT TO** and/or **COOL TO** buttons.
 - Select **RESUME** to remove hold and resume normal scheduled programming.
- ⑨ **HEAT TO** – Select to temporarily adjust heat setting. Raise or lower heat setting to desired temperature. Adjust duration of temporary hold, default is 2 hours.
- ⑩ **COOL TO** – Select to temporarily adjust cool setting. Raise or lower cool setting to desired temperature. Adjust duration of temporary hold, default is 2 hours.
- ⑪ **SETUP** – Opens Basic Setup menu for system programming and other system settings.

Thermostat Guide

Basic Setup Screen



Screen – Set screen settings:

- **Adjust Brightness** – Allows you to set display brightness of the inactive screen for each programming period (Wake, Day, Evening, Sleep).
- **Screen Saver** – Turn screen saver On or Off.
- **Clean Screen** – Disables touch screen for 60 seconds to allow screen to be cleaned. To return to an active screen, press the Home button or wait until time expires.

Time/Date – Set current time and date.

NOTE: Your thermostat automatically receives time and date updates from the network. While connected you cannot override the current time and date settings. In the event of a loss of network communications, the time and date can be set manually.

Sounds – Turns the touch screen “beep” On or Off.

Reminders – Displays system runtime minutes remaining until recommended filter change. Allows you to reset filter reminder.

NOTE: A FILTER button will appear on the Home Screen when the minutes remaining reach 0

Schedule – View and modify your daily heating and cooling programs.

Vacation – Allows you to schedule a vacation hold setting in advance.

Price Response – Not applicable with the Brighten® Conservation Program.

Advanced – Access additional features and system information.

- **Lockout** – Set a 4-digit passcode to lock out the thermostat.
 - *Lock All but Temperature Settings* – allows temporary and permanent holds to be applied but locks all other features.
 - *Lock Everything* – deactivates all options until passcode is entered.
- **USB** – Allows you to download runtime data to a flash drive and also upload a screen saver image file.
- **Version** – Displays current software versions in the thermostat.

NOTE: The following buttons appear throughout various programming screens:

- DONE* – confirms changes and returns to previous screen.
- CANCEL* – cancels changes and returns to previous screen.
- BACK* – returns to previous screen.
- SAVE* – saves current settings.

Programming the Thermostat

The Brighten® iThermostat can be programmed to adjust the home's temperature according to your schedule. Maximize energy savings by setting back the thermostat when you're away from home.

Program Schedules – Choose from one of three program schedules:

- **All Days** – All seven days are programmed with the same daily settings.
- **Weekday/Weekend** – Monday through Friday are all programmed with one daily schedule while Saturday and Sunday can be programmed with a different schedule.
- **Each Day** – Each day can be programmed individually for maximum flexibility.

Programming Periods – There are four periods within each day (Wake, Day, Evening and Sleep). When setting up your daily programming, you'll select the start time as well as heat and cool settings for each period.

View or edit your daily programming schedule

1. Press **SETUP** on the Home screen.
2. Press **Schedule** on the Basic Setup screen.
3. Select schedule type (All Days, Weekday/Weekend, Each Day).
4. Viewing current programming schedule:
 - **All Days** – will display the program schedule that is executed every day.
 - **Weekday/Weekend** – will display the program schedule that is executed every day for both Monday thru Friday and for Saturday and Sunday. Select Weekday or Weekend to switch between each period.
 - **Each Day** – will display the program schedule for each day of the week. Select previous or next to see each day's program settings.

5. To modify time and temperature settings press **EDIT** inside the schedule you want to update:

- Select the **PERIOD** – Use up and down arrow buttons to cycle through the periods.
- Select the **START** time for each period – use up and down arrow buttons to adjust.
- Select the **HEAT TO** setting for each period – use up and down arrow buttons to adjust.
- Select the **COOL TO** setting for each period – use up and down arrow buttons to adjust.
- Repeat for each period – Wake → Day → Eve → Sleep .
- Select **SAVE** to apply new settings.

6. Programming Weekday/Weekend or Each Day programs

- If programming Weekday/Weekend program, repeat step 5 for each Weekday and Weekend period – use Weekend and Weekday button to switch between periods.
- If programming Each Day, then repeat step 5 for each day. Use day buttons to select the previous or next day.

Thermostat Guide

Temporary and Permanent Holds

A temporary hold allows you to override the programmed temperature for a short period of time. The thermostat will automatically apply a 2-hour hold period, but the duration can also be adjusted.

1. From the Home Screen select **HEAT TO** or **COOL TO**.
2. Use colored arrows to adjust temperature to desired setpoint.
3. Use the gray arrows to adjust the hold duration if necessary.
4. Select **DONE** to apply temporary hold.
5. To cancel the temporary hold, press **HOLD** and then **RESUME**.

NOTE: *HOLD UNTIL* will appear in the upper left corner of the home screen.

A permanent hold allows you to override the scheduled setpoint temperature indefinitely until the hold is removed.

1. Follow steps above to select desired temperature setting.
2. Press **HOLD** to apply a permanent hold.
3. To cancel the permanent hold, press **RESUME**.

NOTE: *HOLD* will appear in the upper left corner of the home screen.

Vacation Programming

You now have a convenient way to schedule a special heating or cooling setting while you're away on vacation, or to temporarily override your normal setback programming if you plan to be home during a typical setback period like weekday holidays.

1. Press **SETUP** on the Home screen.
2. Press **VACATION** on the Basic Setup screen.
3. Enter the Vacation Start Date and time then press **NEXT**.
4. Enter the Vacation Return Date and Time then press **NEXT**.
5. Select the System Mode (Heat, Cool or Auto) then press **NEXT**.
6. Select the hold temperature(s) then press **NEXT**.
7. Confirm schedule then press **DONE** to save.

NOTE: *The pending vacation schedule will appear as a message on the Home Screen if the start time is within 30 days.*

Brighten® iThermostat Portal



Your Brighten® iThermostat can be monitored and controlled from most Web-enabled devices. The unique portal allows you to:

1. Check the status of your heating and cooling system.
2. Adjust your programmed settings and apply holds from just about anywhere.
3. See historical system runtime usage and cost estimates, as well as filter reminders.
4. View 30-day forecasted cost estimates based on your thermostat settings.

To access your Brighten® iThermostat from the portal you must have:

- ✓ The gateway plugged in and connected to your high-speed Internet.
- ✓ An Internet browser such as Firefox® (download at mozilla.com) or Internet Explorer® (IE) version 7 or higher (download at microsoft.com/windows/internet-explorer).
- ✓ Your Login and Password.

Logging into the portal from your computer:

1. Open your computer's Web browser.
2. Access the login page at txu.com/myithermostat.
3. Enter your user name (typically your email address) and password.
4. Click **Log In**.

In addition to the Brighten® iThermostat portal, you may also access key thermostat controls using any of the three options below:

1. TXU Energy MyAccount – Sign in to your TXU Energy MyAccount at txu.com to access your thermostat.
2. TXU Energy Mobile Solutions – download the iPhone® or Android™ app, or use the mobile site to access your TXU Energy account as well as your thermostat. Search for “TXU Energy” in the app store or Google Play Share. Thermostat controls can be found in the “Usage” menu.
3. Mobile website – a mobile version of the Brighten® iThermostat portal is available for Web-enabled smartphones. Just type txu.com/control into your smartphone's Web browser and use your portal login to access your thermostat.

NOTE: Your portal login and MyAccount login information may be different.

Online Guide

Dashboard Home Page

The screenshot shows the TXU Energy Dashboard Home Page. At the top left is the TXU Energy logo. To its right is the customer support call number: 1-866-733-1807, Mon-Fri, 8am to 6pm. Further right are links for 'Edit My Profile', 'Manuals', and 'Log Out'. A large temperature display shows 84° with a high of 101°. Below this is a navigation bar with 'DASHBOARD HOME' (circled 1), 'PROGRAM SETTINGS', 'REPORTS & TRACKING', and '1 UNREAD ALERT'. The main content area is titled 'THERMOSTAT HOME' and includes a 'WEATHER FORECAST FOR IRVING, TEXAS' section with 'Currently' (Feels Like 84°), 'Today' (Hi: 101°, Low: 82°), 'Thursday' (Hi: 106°, Low: 82°), 'Friday' (Hi: 93°, Low: 73°), and 'Saturday' (Hi: 94°, Low: 75°). Below the weather are two thermostat control panels for 'Downstairs' and 'Upstairs'. The 'Downstairs' panel shows energy costs (\$1 today, \$63 this month), indoor temperature (79°), temperature setting (79°), keypad lockout status, and system mode (Heat, Cool, Auto, Off). The 'Upstairs' panel shows energy costs (\$1 today, \$76 this month), indoor temperature (77°), temperature setting (77°), keypad lockout status, and system mode (Heat, Cool, Auto, Off). At the bottom is a 'COMMUNICATION STATUS' section showing 'Gateway DigiSEP 480213 Connected', 'Downstairs Connected', and 'Upstairs Connected'. Numbered callouts 1 through 10 point to various elements: 1 (Dashboard Home), 2 (Weather Forecast), 3 (Downstairs Energy Cost Today), 4 (Downstairs Indoor Temperature), 5 (Upstairs Temperature Setting), 6 (Downstairs Keypad Lockout Enabled), 7 (Downstairs System Mode), 8 (Communication Status), 9 (Downstairs Thermostat Icon), and 10 (Edit My Profile).

- ① **Navigation Bar** – Select the page you wish to navigate to.
- ② **Weather Information** – Provides 3-day weather forecast for your area.
- ③ **Estimated Energy Costs** – See daily and month-to-date estimated heating and cooling costs.

NOTE: Estimated costs are derived by system runtime data as well as gas and electricity billing data in your Profile.

- ④ **Current thermostat settings** – See current indoor temperature as well as the current thermostat setpoint.
- ⑤ **The  icon indicates a hold is currently set** – Hover over the icon to identify if it's a temporary or permanent hold.
- ⑥ **Keypad Lockout Enabled?** – Check the box to lock out the thermostat from being controlled at the thermostat. Uncheck to release the lock and allow changes to be made at the thermostat's keypad.

NOTE: Once you enable the keypad lockout a message will temporarily appear at the top of the portal screen. The message will contain a 4-digit passcode which can be used to unlock the thermostat locally. Otherwise you can always unlock the thermostat by unchecking the box in the portal without a passcode.

- ⑦ **System Mode** – View and change the current system mode. To change the mode simply click on the radio button next to the desired mode.

- ⑧ **Communications Status** – Displays current status of communication to your gateway or thermostat(s):
 - (green) indicates communication to the device is active.
 - (red) indicates the device isn't communicating with the network. Thermostat program commands can't be sent, and the portal won't receive reporting information during time periods when communication is down.

NOTE: If the status is red, verify your gateway is powered on and plugged in to the Internet. For assistance, contact the Brighten® iThermostat customer support team at 1-866-733-1807.

- ⑨ **Edit Icon ** – You can change the display name of the thermostat in the portal:
 - 1) Click on .
 - 2) Modify the thermostat name as desired.
 - 3) Click **Save**.

⑩ **Additional Resources**

- **Edit My Profile** – Manage your portal password, energy billing data and system settings.
- **Manuals** – Access detailed user manuals for your thermostat as well as the portal.
- **Log Out** – Closes the portal and returns to the login screen.

Online Guide

Device Programs Page

- ① **Device** – Shows which thermostat you’re viewing. If you have more than one thermostat, select the thermostat you wish to view or program.
- ② **Program Type** – Initially displays current program schedule. To change, select the radio button next to the desired program type.
 - All Days – A program schedule that is executed every day.
 - Weekday/Weekend – A program schedule that is customized weekdays (Monday through Friday) and for weekend days (Saturday and Sunday).
 - Each Day – A program schedule customized for each day of the week.

NOTE: Changes will not take effect until you click Save Changes To Device

- ③ **My 30 Day Spending Forecaster** – This unique tool displays the forecasted energy cost for the next 30-day period. It compares your current program values with the 30-day weather forecast for your area and then estimates the associated heating and cooling costs. Select Cooling or Heating to see forecasted cost for each. There are three ways to use the tool to see how small changes may impact your energy costs over the next 30 days.
 1. Change your daily programming in the programming section in #4. As you make changes to your period start times and/or temperature settings, the Forecasted Cost will update accordingly.
 2. Use the Temperature Adjustment bar to see how changes to your daily temperature settings could impact your Targeted Cost. If you want to apply the change, select Update Program and the Temperature Adjustment amount will be applied to all of your heating or cooling setpoints.

Change Your Program Settings

3. Enter a Targeted Cost to see how much of a temperature change it would take to all of your programmed setpoints to achieve the targeted cost.

NOTE: If you enter a value that would require more than a 5° temperature change, then the tool will default to a 5° change and display the associated cost difference.

If you want to apply the Temperature Adjustment shown then click **Update Program** to apply the changes to your daily programs. Then click **Save Changes To Device** to push the new programming to your thermostat.

- ④ **Daily thermostat programming** – The tables and graphs initially display the current program settings in your thermostat.
- ⑤ When you're ready to apply any programming changes to your thermostat, click **Save Changes to Device**.

TIP: Refer to the Recommended Programming Guide on page 14 for ENERGY STAR® recommended settings.

To change your program settings:

1. Select Device.
2. Select new Program Type (if necessary).
3. Adjust the start time for each period.

NOTE: You can adjust the period start times and temperature setpoints three ways:

1. Use the icons

- Click the clock icon to select a start time.
- Click the up and down arrows to adjust the temperature setpoint.

2. Enter a value

- Highlight the value you want to change and type in a new value.
- Hit tab or enter on your keyboard or click anywhere else on the page to make the change. Times will round to the nearest 15 minute increment.

3. Grab and drag a circle in the graph

- Drag up and down to change the temperature.
- Drag left or right to change the time. Times will round to the rest 15 minute increment.

4. Adjust the Cooling and Heating settings for each period.
5. Repeat for each day or period.
6. Click **Save Changes To Device** at the bottom of the page.
7. Then click **Save Changes To Selected Devices**.

NOTE: If you have more than one thermostat, you can select which thermostats to apply the new programming to.

Online Guide

Set and Schedule Holds Page

The Set and Schedule Holds page under the Program Settings tab allows you to apply three types of holds to your thermostat:

1. **Temporary Hold** – Applies a heating or cooling hold for the next two hours.

- 1) Select a thermostat.
- 2) Select Temporary Hold.
- 3) Select Mode.
- 4) Enter hold temperature.
- 5) Click **Apply Hold**.

The temporary hold will be applied for the next two hours. To remove the hold, select the appropriate thermostat, select Temporary Hold and then click **Remove Hold**. Hold can also be removed at the thermostat.

2. **Permanent Hold** – Applies a heating or cooling hold until the hold is removed.

- 1) Select a thermostat.
- 2) Select Permanent Hold.
- 3) Select Mode.
- 4) Enter hold temperature.
- 5) Click **Apply Hold**.

The permanent hold will be applied until it is removed. To remove the hold, select the appropriate thermostat, select Permanent Hold and then click **Remove Hold**. Hold can also be removed at the thermostat.

3. **Scheduled (Vacation) Hold** – Allows you to schedule a future hold.

- 1) Select a thermostat.
- 2) Select Scheduled Hold.
- 3) Select Create.

4) Use icons or enter values for:

- Start Date and Time.
- Stop Date and Time.
- Mode.
- Hold Temperature.

5) Click **Save**.

The hold will be applied at the date and time selected. To cancel the scheduled hold, select the appropriate thermostat, select Scheduled Hold then click the red icon  next to the scheduled hold.

IMPORTANT: The Gateway must be plugged in and communicating for the hold to be applied.

Cycling Event Opt Out Page

The Cycling Event Opt-Out page under the Program Settings tab allows you to opt out of a current cycling event or schedule an opt-out for a future date. Any opt-out will be applied for the entire day or remainder of the day selected. A cycling event is a period of time when TXU Energy will reduce the demand for electricity from heating and cooling systems by cycling customer's systems off and on. Cycling events are typically performed during peak periods when electricity demand is highest and each event may last up to 15 minutes every half hour.

To opt out of a current event or to schedule an opt-out for a future date:

- 1) Select a thermostat.
- 2) Select Create.
- 3) Use the calendar icon to select the current or future date.
- 4) Click **Save**.

Reports & Tracking Page

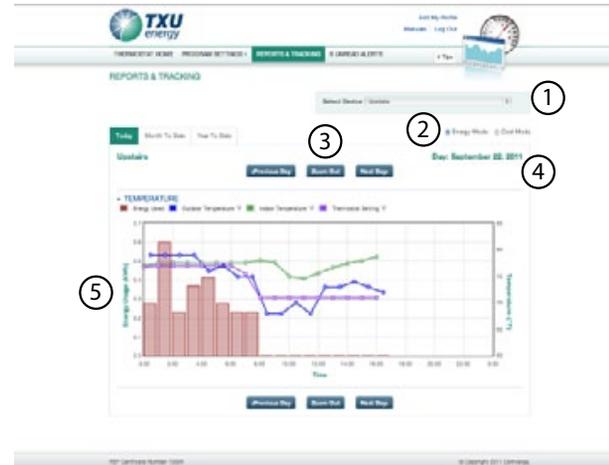
The Reports & Tracking page allows you to view historical information about your air conditioning and heating system such as estimated energy cost, energy usage and temperature settings. You can display reports for the following periods:

1. Daily – by hour.
2. Monthly – by day.
3. Yearly – by month.

IMPORTANT: Your gateway must remain on at all times in order for your data to be accurately captured.

NOTE: Your thermostat sends a "status report" every 15 minutes to your portal. This information is then used for reporting as well as for energy cost estimates throughout the portal.

- ① **Select the thermostat you wish to view.**
- ② **Switch between Energy Mode view and Cost Mode view**
 - Energy Mode shows you the estimated energy used during the period in kWh (bars in graph will be red).
 - Cost Mode shows you the estimated cost used during the period (bars in graph will be blue).
- ③ **Navigation buttons** – Allow you to view different periods of time:
 - Previous Period – view previous Day/Month/Year.
 - Zoom Out – in Day View, zoom out to Month; in Month View, zoom out to Year.
 - Next Period – view next Day/Month/Year.
- ④ **Date range** – shows which period of time you are currently viewing.



- ⑤ **Graph section** – displays historical information for the thermostat selected. See average temperatures during a period, including indoor temperature, thermostat setpoint and outdoor temperature. Hover over any bar to see usage or cost information for that period.

TIP: Use the graph to compare daily costs estimates or to check system performance. Raise or lower your thermostat temperature during the day period and then compare daily cost estimates before and after the change to see how the change impacted your energy usage.

Alerts Page

The Alerts page displays messages from your thermostat or TXU Energy such as weekly usage summaries and when to change your filter. Alerts remain until you delete them. Click the red icon  to delete an alert.

Brighten® Conservation Program

The Brighten® Conservation Program

You can control your own energy savings by setting your heater and air conditioner to run less frequently. The Brighten® Conservation Program creates another way for you to save. The mercury can really rise during Texas summers. When the temperature soars, many Texans crank the temperature down on their air conditioners, creating a big demand on the state's electricity grid. By participating in the Brighten® Conservation Program, you're now a part of the solution by allowing TXU Energy to cycle your air conditioner during high demand periods. These typically fall on weekday afternoons during the hot summer months.

- Cycling – Your air conditioner may be turned off for a brief time (up to 15 minutes out of a 30-minute period) during high-demand usage periods such as during the day when most businesses are running and air conditioners are still on in residential homes. Odds are you probably won't even notice when your air conditioner is cycled off and on.
- Conserve resources – Combine the times your air conditioner is cycled off with that of all the other Brighten® Conservation Program customers and the strain is reduced on the state's electrical network, which can help reduce power outages resulting from heavy electricity demand on extremely hot summer days.

While the change is small in your home, cycling many air conditioners during critical demand periods can reduce demand on the Texas electricity grid considerably.

To opt out of a cycling event, simply go to the Opt-Out page in the portal or call the Brighten® iThermostat customer service team at 1-866-733-1807.

Brighten® iThermostat Recommended Programming Guide

TXU Energy recommends the following temperature set points, based on ENERGY STAR guidelines.

<i>Setting</i>	<i>Period</i>	<i>Time</i>	<i>Setpoint Temperature</i>
Cool	WAKE	6 a.m.	≥ 78° F (≥ 25.5° C)
	DAY	8 a.m.	Increase by at least 7°F
	EVENING	6 p.m.	≥ 78° F (≥ 25.5° C)
	SLEEP	10 p.m.	Increase by at least 4°F
Heat	WAKE	6 a.m.	≤ 70° F (≤ 21.1° C)
	DAY	8 a.m.	Decrease by at least 8° F
	EVENING	6 p.m.	≤ 70° F (≤ 21.1° C)
	SLEEP	10 p.m.	Decrease by at least 8° F

*Source: Energystar.gov



Have Questions? See our Frequently Asked Questions online at txu.com/ithermostat or call 1-866-733-1807

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