

A distributed power outlet power monitoring system

Field of the Invention

[1] The present invention relates to power monitoring and in particular, but not necessarily entirely, to a distributed power outlet power monitoring system.

Background and Summary of the Invention

[2] Monitoring systems are used to alert users of problem and fault conditions.

[3] For example, US 20070139183 A1 (D1) discloses a sensor system that provides sensor information to a portable monitoring unit ("PMU") for alerting building or complex management, or other responsible parties, to a potential problem detected by the sensor system.

[4] The system of D1 uses a sensor unit that measures readings from a sensor and has a battery power source for powering the sensor during power outages (see Fig 2) and wherein an alert is sent of the sensor reading is abnormal (See Fig 6).

[5] Furthermore, US 20090153338 A1 (D2) discloses a power alert system installed at a consumer premises. The power alert system comprises a power status transmitter, which is installed at the consumer premises. The power status transmitter is configured to notify a status of power supply to a handheld device of the consumer. The power status transmitter notifies to the handheld device of the consumer the status of the power supply by one of an email communication and a text message communication.

[6] The present invention provides a distributed power outlet power monitoring system that is used to monitor and alert of electrical device power outages.

[7] In embodiments, the present system can be used as a consumer product, having relatively inexpensive and robust sensors that are furthermore relatively easy to set up and configure.

[8] However, the systems of D1 and D2 are problematic and the present system provides advantages over the sensor systems of D1 and D2.

[9] Firstly, the sensors of D1 and D2 are complex in construction including for reasons of requiring inbuilt power sources.

[10] Specifically, the sensors of D1 have internal power sources (e.g., battery, solar cell, fuel cell, etc.) (para. 48 of D1) and goes to great lengths to reserve the power thereof, including alternately entering wake and sleep cycles. D2 also inherently has powered sensors wherein for example, when power supply is cut, i.e., in OFF status, the power status detector 104 informs the power status transmitter 102 about the power cut (para 17 of D2).

[11] However, the present system uses power monitoring units that require no internal power thereby allowing for less expensive sensors that further do not suffer disadvantages associated with maintaining battery supplies requiring recharging and degradation over time.

[12] Furthermore, the systems of D1 and D2 are difficult to configure and set up. Specifically, D1 requires various components including sensor units, repeater units, base unit, and the PMU including the programming of the sensors with first and second codes (para 81 of D1) and requires the configuration of the repeater to inspect packets of data to determine if the packet should be forwarded (para 80 of D1) and uses repeater delays to reduce the chance of packet collisions. D2 does not disclose the configuration of the sensors at all.

[13] However, the present system employs a setup process that enables the relatively quick and simple configuration of the various power reporting units.

[14] As such, the present invention overcomes or substantially ameliorate at least some of the deficiencies of the prior art, or to at least provide an alternative.

[15] Specifically, the claimed invention uses relatively inexpensive power reporting units (not sensors) that draw power from the same power outlets of the associated electrical device being monitored (thereby requiring no internal power supply) and wherein, whilst being powered in this manner, each power reporting unit periodically sends power status notifications to a central server across the internet and wherein the central server monitors the continual receipt of the power status notifications. As such, lack of receipt of the power status notifications for a period is indicative of a loss of power to the electrical device.

[16] Furthermore, the claimed invention employs a setup process that allows for the relatively quick and simple connection of the power reporting units to a home/premises wireless communication system, pairing of the power reporting units to the central monitoring server and the configuration of alert settings.

[17] It is to be understood that, if any prior art information is referred to herein, such reference does not constitute an admission that the information forms part of the common general knowledge in the art, in Australia or any other country.

[18] As such, with the foregoing in mind, in accordance with one embodiment, there is provided a distributed power outlet power monitoring system the system comprising: at least one power reporting unit having a power input, a power output, a memory device and a wireless computer data network interface, the power reporting unit drawing operational power from the power input using a power adapter; the wireless computer data network interface configured for sending data across the Internet via a wireless Internet router; and the memory device configured for storing a GUID assigned

to the power reporting unit and wireless data communication network authentication credentials; a monitoring server in operable communication with the power reporting unit across the Internet; a client terminal in operable communication with the monitoring server across at least one of the Internet and a GSM network wherein, in use: the power reporting unit, client terminal and monitoring server are configured for implementing a setup process wherein: the memory device of the power reporting unit is configured with authentication credentials of a wireless network of the e wireless Internet router; the GUID is sent to the monitoring server from either of the client terminal and the power reporting unit; the monitoring server is configured for storing the GUID uniquely identifying the power reporting unit and associating the GUID against a user account; the monitoring server is configured for storing at least one alert configuration setting against a user account, the least one alert configuration setting comprising at least one of a messaging destination address for the client terminal; and wherein, during operation, the power reporting unit, client terminal and monitoring server are configured for implementing a power monitoring process wherein: while receiving power via the power inlet the power reporting unit is configured for sending periodic power status messages at a first periodic interval to the monitoring server across the internet via the wireless Internet router; the monitoring server is configured for receiving the power status messages and associating the power status messages with the GUID; the monitoring server is configured for detecting the lack of receipt of at least one power status message within a threshold period being at least twice that of the first periodic interval; and the monitoring server is configured for sending an alert message to the client terminal accordingly.

[19] The power reporting unit may be configured for generating the GUID in a pseudorandom number.

[20] The messaging destination address may comprise at least one of an email address and mobile phone number.

[21] The monitoring server may be further configured for sending a power resumption alert message to the client terminal upon receiving a further power status message from the power reporting unit.

[22] The monitoring server may be configured for measuring a power outage duration and serving, to the client terminal, a webpage comprising a display of the power outage duration for the power reporting unit.

[23] During the setup process, the power reporting unit may be configured for setting up an ad hoc Wi-Fi hotspot.

[24] During the set up process, when the client terminal connects to the ad hoc Wi-Fi hotspot, a browser application of the client terminal may be configured to display a landing configuration web page served by the power reporting unit.

[25] During the setup process, the authentication credentials of a wireless network of the wireless Internet router are input into the landing configuration web page and stored by the power reporting unit.

[26] During the setup process, after having received the authentication credentials, the power reporting unit may be configured for redirecting the browser application of the client terminal to a URL served by a web server of the monitoring server.

[27] When redirecting the browser application, the power reporting unit may be configured for closing the ad hoc Wi-Fi hotspot.

[28] The URL may comprise the GUID as a URL parameter.

[29] When receiving a request for the URL from the client terminal, the monitoring server may be configured for storing the GUID uniquely identifying the power reporting unit and associating the GUID against a user account.

[30] When receiving a request for the URL from the client terminal, the monitoring server may be configured for serving a web page to the client terminal requiring the authentication with an existing user account or the creation of a new user account.

[31] When sending a power status message to the monitoring server, the power reporting unit may be configured for requesting a URL served by a webserver of the monitoring server.

[32] The power reporting unit may be configured for including the GUID as a URL parameter when requesting the URL.

[33] When sending a power status message to the monitoring server, the power monitoring server may be configured for sending a network ping request to an IP address associated with the power reporting unit.

[34] Other aspects of the invention are also disclosed.

Brief Description of the Drawings

[35] Notwithstanding any other forms which may fall within the scope of the present invention, preferred embodiments of the disclosure will now be described, by way of example only, with reference to the accompanying drawings in which:

[36] Figure 1 shows a power outlet distributed power monitoring network in accordance with an exemplary embodiment;

[37] Figure 2 shows a distributed power outlet power monitoring system in accordance with an exemplary embodiment;

[38] Figure 3 shows the Model View Controller (MVC) diagram of the central power monitoring server of the system of Figure 2 in accordance with an example embodiment;

[39] Figure 4 shows the Model View Controller (MVC) diagram of the power reporting units of the system of Figure 2 in accordance with an example embodiment; and

[40] Figure 5 shows an exemplary method for the initial setup and subsequent power monitoring implemented by the system of Figure 2 in accordance with an example embodiment.

Description of Embodiments

[41] For the purposes of promoting an understanding of the principles in accordance with the disclosure, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the disclosure is thereby intended. Any alterations and further modifications of the inventive features illustrated herein, and any additional applications of the principles of the disclosure as illustrated herein, which would normally occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the disclosure.

[42] Before the structures, systems and associated methods relating to the distributed power outlet power monitoring system are disclosed and described, it is to be understood that this disclosure is not limited to the particular configurations, process steps, and materials disclosed herein as such may vary somewhat. It is also to be understood that the terminology employed herein is used for the purpose of describing particular embodiments only and is not intended to be limiting since the scope of the disclosure will be limited only by the claims and equivalents thereof.

[43] In describing and claiming the subject matter of the disclosure, the following terminology will be used in accordance with the definitions set out below.

[44] It must be noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise.

[45] As used herein, the terms "comprising," "including," "containing," "characterised by," and grammatical equivalents thereof are inclusive or open-ended terms that do not exclude additional, unrecited elements or method steps.

[46] It should be noted in the following description that like or the same reference numerals in different embodiments denote the same or similar features.

Distributed power monitoring network 100

[47] Turning now to figure 1, there is shown an exemplary distributed power monitoring network 100. As will be described in further detail below, the network 100 is configured for monitoring the provision of power to a plurality of electrical devices 106 drawing electrical power from at least one general power outlet 105.

[48] As can be seen, the network 100 comprises a plurality of power reporting units 104 which interface each electrical device 106 and GPO 105. As can be further seen, the power reporting units 104 are in operable communication with a monitoring server 103 across the Internet 102.

[49] In this way, and as will be described in further detail below, during the initial setup phase, one or more power reporting units 104 are associated with the monitoring server 103 such that, during use, the power reporting units 104 may send power status messages to the monitoring server 103.

[50] Should the monitoring server 103 fail to receive a power status message from a power reporting unit 104 during a predetermined interval, the monitoring server 103 may deduce that power has failed to the associated electrical device 106 and therefore send an alert message to the client terminal 101.

Distributed power monitoring system 200.

[51] Turning now to figure 2, there is shown a distributed power monitoring system 200 in accordance with an exemplary embodiment. As can be appreciated, the componentry of the system 200 may be arranged according to the network architecture 100 of Figure 1.

[52] Figure 2 shows the monitoring server 103, client terminal 101 and power reporting unit 104 in further detail.

[53] Specifically, the monitoring server 103 may take the form of a physical rack mounted or virtualised server instance (such as which may be implemented by Amazon web services (AWS)).

[54] As is shown, the monitoring server 103 comprises a processor 209 for processing digital data.

[55] The server 103 further comprises a memory device 210 in operable communication with the processor 209 across a system bus 208. The memory device 210 is configured for storing digital data including computer program code.

[56] In this regard, the memory device 210 may comprise an operating system 207 such as the Linux kernel. As such, during the bootstrap phase of the server 103, the operating system 207 may be loaded and executed by the processor 209. Furthermore, the memory device 210 may comprise a plurality of web applications for the purposes of communicating with the various computer componentry provided in Figure 2 across the Internet 102. In this regard, the web application may comprise a webserver application 205 for responding to web requests across the Internet 102.

[57] Furthermore, for the purposes of implementing the functionality described herein, and as will be described in further detail below with reference to Figure 3, the memory device 210 may be provided with a plurality of software modules which, for illustrative convenience have been divided in figure 2 into data model 201, controller 202 and view 203 modules. In general terms, the data model 201 controls the data and data structure and the view module 203 controls the user interface, including that which is displayed by the client terminal 101. Furthermore, the controller 202 controls the usage and manipulation of the data within the data model 201 including in interfacing the view 203 and the data model 201.

[58] The server 103 may further comprise an I/O module 212 for interfacing with various computer peripherals including user interface and data storage peripherals. For the latter, the computer program code for the purposes of implementing the functionality described herein may be provided to the server 103 by way of a memory storage device, such as a USB device or the like.

[59] Furthermore, the server 103 may comprise a network interface card (NIC) 211 for the purposes of sending and receiving data across the Internet 102.

[60] Similarly, the client terminal 101 comprises a processor 209 for processing digital data and a memory device 210 in operable communication with the processor 209.

[61] In embodiments, a software application “app” 213 may be downloaded for installation and execution by the client terminal 101. In alternative embodiments, the client terminal 101 may interact with the monitoring server 103 utilising a web browser application.

[62] Similarly, the client terminal 101 may comprise an I/O interface 212 for interfacing with various computer peripherals including user interface peripherals including the digital display device 223 shown. As such, the client terminal 101 may interact with the 100 server 103 utilising the digital information displayed by the device 223.

[63] Turning now to the power reporting unit 104, in preferred embodiments, the power reporting unit 104 takes the form of a relatively inexpensive small form factor device which may be conveniently interfaced between an electrical device 106 via power outlet 219 and a general power outlet 104 via power input 217.

[64] As is represented, and in a preferred embodiment, the power reporting unit 104 further comprises a processor 209 for processing digital data and a memory device 225 for storing computer program code. In embodiments, the processor 209 and associated memory device 225 may take the form of an embedded controller, such as a FPGA device. Importantly, the memory device 225 may take the form of nonvolatile RAM/flash memory so as to persist data configuration settings across power outages.

[65] In this regard, the power reporting unit 104 may take the form of a ruggedised unit, such as approximately the size of a pack of cigarettes wherein the power input 217 and power output 219 take the form of male and female electrical sockets.

[66] As such, the physical installation of the power reporting unit 104 may be as simple for the end user as plugging the power reporting unit 104 into the GPO 105 and the electrical device 106 into the power reporting 104.

[67] The power reporting unit 104 essentially provides power “flow through” providing little or no electrical resistance between the GPO 105 unit and the electrical device 106.

[68] As such, the power reporting unit 104 has adequate power and current rating so as to be suited for differing types of electrical devices 106, such as refrigerator units, television units, a conditioning units and other household appliances.

[69] In a preferred embodiment, the power reporting unit 104 draws operational electrical power (i.e. for the operation of the power reporting unit 104) from the GPO 105 and therefore may comprise an AC/DC power adapter 216.

[70] Specifically, the power reporting unit 104 may operate on 5 V levels and therefore draw the requisite 5 V power via the AC/DC power adapter 106.

[71] As such, in one embodiment, the power reporting unit 104 is configured to monitor power in that, while electrical power is supplied via the GPO 105, the power reporting unit 104, drawing operational electrical power via the power adapter 216 is operational. While operational, the power reporting unit 104 is able to send periodic power status messages to the monitoring server 103.

[72] However, should power fail at the GPO 105, the power reporting unit 104 itself depowers so as to become nonoperational such that no further periodic power status messages are sent to the monitoring server 103. As such, and in the manner described in further detail below, the monitoring server 103 is able to detect the loss of power to the electoral device 106 by detecting the lack of receipt of periodic power status messages.

[73] As can be appreciated, the design architecture of the power reporting unit 104 drawing operational electrical power via the GPO 105 simplifies the construction of the power reporting unit 104 allowing for the relatively an expense of manufacture thereof. Specifically, the power reporting unit 104 need not be operational during power outages for the detection of power outages by the system 200 and therefore need not necessarily comprise expensive and failure prone battery storage or the like.

[74] In certain embodiments, the power reporting unit 104 may comprise a sensor 218 for sensing various parameters including temperature, humidity, voltage levels and the like. In this regard, the

power reporting unit 104 may comprise an analogue to digital converter 221 configured to receive analog sensor levels from the sensor 218 which may be then reported to the processor 209.

[75] Furthermore, the power reporting unit 104 comprises a wireless network interface card 222 so as to allow the power reporting unit 104 to report wirelessly across the Internet 102. In a preferred embodiment and as will be described in further detail below, the power reporting unit 104 is configured to communicate via a home/premises network router 227 across the Internet 102.

[76] As can also be seen from figure 2, the nonvolatile memory 225 may further comprise MVC modules for utilisation in the manner described with further reference to figure 4.

Monitoring server MVC (MVC) 300

[77] Turning to figure 3, there is shown the MVC 300 for the monitoring server 103 in accordance with an illustrative embodiment.

[78] Considering initially the controller 202, as can be seen, the controller 202 may comprise a device registration controller 305. As will be described in further detail below, the monitoring server 103 is configured for registering a plurality of power reporting units 104 so as to be able to subsequently monitor the power reporting units 104.

[79] In a preferred embodiment, power reporting units 104 are identified uniquely within the system 200, including via a GUID (global unique identifier) 301. As such, the MVC 300 may store the GUID 301 within the data model 201. The GUID 301 is stored in relation to a plurality of devices 302 within the data model 201 and the devices 302 are further stored in relation to a plurality of user accounts 303. In this manner, users may create a plurality of respective user accounts 303 for the association and monitoring of a plurality of power reporting units 104. For example, for a household, a user may create a user account for the household and manage a plurality of power reporting units 104, such as a network of six power reporting units 104 within that household.

[80] As can be further seen from figure 3, user settings 304 may be further stored in relation to the user accounts 303 within the data model 201.

[81] Relatedly, the controller 202 comprises a user registration controller 306 which is configured for registering users, including when registering devices 305 in the manner described herein.

[82] Furthermore, the controller 202 comprises a device monitoring controller 307 configured for monitoring the various registered power reporting units 104 in the manner described herein.

[83] Furthermore, the controller 202 may comprise an alerting controller 308 configured for sending an alert upon detecting the failure of the power supply to an electrical device 106 including in the manner described herein in further detail below.

[84] The views 203 of the MVC 300 may be configured for controlling the user interfaces displayed by the display device 223 of the client terminal 101.

[85] As such, the view 203 may comprise an account set up view 309 allowing a user to create an account, configure various settings, registered various power reporting units 104 and the like.

[86] Furthermore, the view 202 may comprise a status and/or stats view 310 used by the user for viewing various statistical and statuses of the power reporting units 104.

[87] Furthermore, the view 203 may comprise an alert view 311 which may be used to display alerts to the user.

Model view controller (MVC) 400 of the power reporting unit 104

[88] Turning now to figure 4, there is shown the MVC 400 of the power reporting unit 104 in accordance with an illustrative embodiment.

[89] As alluded to above, the computer program code and associated data may be stored within the nonvolatile flash memory 225 of the power reporting unit 104 which, in embodiments, may be periodical updated utilising over the air (OTA) firmware updates.

[90] As can be seen, the controller 226 comprises a bootstrap controller 405 which is initiated after power up.

[91] Specifically, during the bootstrap phase 405, the bootstrap controller 405 determines whether the power reporting unit 104 has been set up and, if not, initiate a set up process in the manner described in further detail below.

[92] During the set up process, the controller 226 may comprise a Wi-Fi setup controller 406 configured for setting up the power reporting unit 104 to authenticate with the router 227 and a GUID generation controller 407.

[93] In this regard, the data model 224 may store various data within the power reporting unit 104 including the GUID 401 and router authentication credentials 403.

Exemplary embodiment

[94] Having generally describe the technical architecture above, there will now be provided an exemplary embodiment provided by way of method 500 for power outlet power monitoring.

[95] It should be noted that the method 500 is exemplary only and provided for illustrative purposes and therefore that no technical limitation should necessarily be imputed to all embodiments accordingly and that modifications may be made thereto within the purposive scope of the embodiment provided herein.

[96] The method 500 shows the interaction between the power reporting unit 104, monitoring server 103 and client terminal 101 across 15 steps.

[97] Now, a user wishes to monitor power outages at the user's home including for monitoring the power supply to the user's deep-freeze (so as to avoid costly replacement of perishables) and the user's fish tank oxygen pump.

[98] As such, the user purchases two power reporting units 104 and, for each of the fridge and fish tank, plugs each respective power reporting unit 104 into the proximate GPO 105 and the respective fridge or fish tank into the female power output socket 219 of the power reporting unit 104.

[99] At step 1, the user then turns on the GPO 105 switch such that power flows via the power reporting unit 104 to the electrical device 106.

[100] As such, the power reporting unit 104, by drawing operational power via the power adapter 216 then powers on and initiates an initial bootstrap process at step 2.

[101] The bootstrap process 2, by inspecting the data within the data model 224 identifies whether the power reporting unit 104 has been initialised yet. In this case, the power reporting unit 104 has not yet been initialised and the bootstrap process then initiates the initial setup process.

[102] Specifically, in accordance with this illustrative embodiment, the initial setup process entails the power reporting unit 104 setting up an ad hoc Wi-Fi hotspot at step 3.

[103] Specifically, in one embodiment, the power reporting unit 104 may utilise the Wi-Fi network interface 222 to initiate an unsecured temporary Wi-Fi hotspot with an obvious SSID such as "power reporting unit".

[104] As such, utilising the client terminal 101 (especially where the client terminal 101 takes the form of a mobile communication device such as a smart phone device), at step 4, the user may connect to the power reporting unit 104 for the initial setup. Specifically, utilising the Wi-Fi network setup process of the client terminal 101 the user may scan for available Wi-Fi networks and select the ad hoc Wi-Fi hotspot created by the power reporting unit 104.

[105] Upon connection, the ad hoc Wi-Fi hotspot may be configured to redirect the client terminal 101 to a landing web page served by the power reporting unit 104. In a preferred embodiment, the client terminal 101 interacts with the power reporting unit 104 by way of web browser application so as to avoid the requirement for the installation of a custom software application. However, it should be appreciated that, in alternative embodiments, the user may install a custom software application so as to implement enhanced features and functionality.

[106] The initial landing page may display various information to the user including allowing the configurations of various settings.

[107] During the configurations of the various settings, at step 5, the user may provide the authentication credentials for the home router 227 so as to allow the power reporting unit 140 subsequently authenticate with the router 227 for the purposes of communicating across the Internet.

[108] In embodiments, such authentication credentials may be provided automatically to the power reporting unit 104 via the app 213 or, in alternative embodiments, the user may select from a drop-down list of available Wi-Fi networks and, for the home network, provide the Wi-Fi password.

[109] Upon receipt of the router authentication credentials, the power reporting unit 104 may store the authentication credentials within the data model 224.

[110] Now, at step 6, the power reporting unit 104 may generate a GUID which may be subsequently used for the unique identification of the power reporting unit 104 within the system 200.

[111] In one embodiment, the processor 209 of the power reporting unit 104 generates the GUID in a pseudorandom manner during the setup phase and stores the generated GUID within the memory device 225. As such, in this embodiment, the power reporting units 104 are provided initially with no GUID and wherein the GUID is generated upon first-time usage during the set up process.

[112] Preferably, the length of the GUID is sufficiently long so as to statistically reduce the probability of GUID collision to practically zero.

[113] It should be noted that in alternative embodiments, each power reporting unit 104 may be uniquely identified in other manners. For example, in one embodiment, each power reporting unit 104 is configured with a GUID during the manufacture thereof.

[114] In other embodiments, a network ID is utilised for uniquely identifying the power reporting unit 104, such as the IP address or MAC address of the power reporting unit 104.

[115] In certain embodiments, the power reporting unit 104 may comprise a reset button (or able to be reset via the client terminal 101) to reset the GUID so that the power reporting unit 104 may be used by another user, for example

[116] In further embodiments, when first contacting the monitoring server 103 during the initial setup, the monitoring server 103 may select a GUID (such as from a database table primary index) and provide such to the power reporting unit 104 for storage within the memory device 225.

[117] At step 7, the power reporting unit 104 is then configured to redirect the client terminal 101 to the monitoring server 103.

[118] Specifically, in one embodiment, the power reporting unit 104 may redirect the browser of the client terminal 101 to a URL or IP address associated with the monitoring server 103.

[119] Simultaneously, the power reporting unit 104 may close the ad hoc Wi-Fi hotspot so as to force the client terminal 101 to reconnect to the router hotspot 227 (or GSM network) so as to allow access of the client terminal 101 to the Internet.

[120] The redirect URL may comprise the GUID generated by the power reporting unit 104 as a URL parameter such that, when requesting the resource utilising the dynamically generated URL, the monitoring server 103 is able to inspect the GUID from the URL parameters and create an entry within the data model 201 for the power reporting unit 104 containing the GUID. Other information may be provided also by either the URL parameters for the client terminal 101.

[121] At step 8, the monitoring server 212 is configured for allowing the user to sign in or create a user account.

[122] For any created or existing user account, at step 9 these user is able to set various operational configurations settings.

[123] Differing configurations settings may be configured by the user via the web interface exposed by the monitoring server 103 to control various aspects of the operation of the server 200, including the communication preferences, operational preferences and the like. For example, the user may specify that the user wishes to receive power outage alerts via SMS, email or the like, or a combination of both.

[124] Furthermore, for each power reporting unit 104 registered with the monitoring server 103, the user may provide a friendly name such as “fridge power monitoring unit”, “fish tank monitoring unit” and the like. In embodiment, the friendly name may be renamed so as to, for example, allow the user to move the power reporting unit to differing locations and update the name accordingly.

[125] Furthermore, the user may specify alert configurations settings wherein, for example, in the situation wherein the home router 227 periodically drops out, the user may specify a longer alert time threshold wherein the monitoring server 103 is configured for only sending an alert should a power failure to the fridge exceed one hour. The user may set alert configurations settings for each power reporting unit 104 so as to be able to, for example, be able to specify a differing alert time threshold for the fish tank.

[126] At step 10 - 12, the power reporting unit 104 is configured for sending periodic “alive” power status notification settings to the monitoring server 103.

[127] Specifically, at periodic intervals, such as every second, the power reporting unit 104 is configured to send a message via the router 227 to the monitoring server 103 identifying the power reporting unit 104.

[128] There are differing manners by which the power reporting unit 104 sends such notifications to the monitoring server 103. In one embodiment, the power reporting unit 104 may request a status reporting URL served by the webserver 205 and provide the UID as a URL parameter.

[129] However, in other embodiments, the monitoring server 103 may, knowing the IP address associated with the power reporting unit 104, send a network ping command to the IP address of the power reporting unit 104 so as to monitor the reply. Alternatively the power reporting unit 104 may ping the monitoring server 103 wherein the ping either comprises a GUID or wherein the origin IP address is determined by the server 103 so as to be able to identify the power reporting unit 104.

[130] The power status message may include other information over and above the GUID including sensor data wherein, for example, additional XML POST data may be sent to the monitoring server 103 comprising various sensor readings of the various sensors 218.

[131] In one embodiment, the monitoring server 212 is configured for initiating a counter for each power reporting unit 104 that increments every second. As such, for each power status monitoring notification, the monitoring server 212 is configured for resetting the associated counter.

[132] However, at step 13 and 14 should a particular count associated with a particular power reporting unit 104 exceed the threshold set as per the configurations settings, the monitoring server 103 may deduce that a power outage may have occurred at the GPO 105 of the associated power reporting unit.

[133] As such, at step 15, the monitoring server 103 may be configured for sending an alert to the associated client terminal 101 as is specified by the communication settings of the associated user account.

[134] As alluded to above, the alert may be sent in differing manners, including via email, SMS notification, push notification and the like. In certain embodiments, the alert may be sent via a social media platform wherein, for example, the user may log into the system 200 utilising a Facebook account such that for subsequent alerts, the alerts may be sent via the Facebook platform to the user, such as by way of messages, updates, news feed updates and the like. In this embodiment, alerts may be sent also to friends of the social user such as wherein, for example, the user does not respond to an alert.

[135] The alert may identify the associated power reporting unit 104 experiencing power outage and preferably includes the friendly name assigned by the user such that, for example, the SMS message to the user may read "fridge power outage detected at 12:07PM".

[136] In an embodiment, the monitoring server 103 may be configured for sending power restoration alerts to the user also should power status messages again be received from the power reporting unit 104.

[137] As alluded to above, utilising the status/stats view 310, the user may view various status information and statistics. For example, for each registered power reporting unit 104, the user may view those which are currently receiving power and those which are not.

[138] Furthermore, for power outages, the server 103 may record the power outage duration which may be important for temperature sensitive perishables wherein, for example, a restaurant may be required to replace perishable stock during a power outage in excess of one hour.

Interpretation

Wireless:

[139] The invention may be embodied using devices conforming to other network standards and for other applications, including, for example other WLAN standards and other wireless standards. Applications that can be accommodated include IEEE 802.11 wireless LANs and links, and wireless Ethernet.

[140] In the context of this document, the term "wireless" and its derivatives may be used to describe circuits, devices, systems, methods, techniques, communications channels, etc., that may communicate data through the use of modulated electromagnetic radiation through a non-solid medium. The term does not imply that the associated devices do not contain any wires, although in some embodiments they might not. In the context of this document, the term "wired" and its derivatives may be used to describe circuits, devices, systems, methods, techniques, communications channels, etc., that may communicate data through the use of modulated electromagnetic radiation through a solid medium. The term does not imply that the associated devices are coupled by electrically conductive wires.

Processes:

[141] Unless specifically stated otherwise, as apparent from the following discussions, it is appreciated that throughout the specification discussions utilizing terms such as "processing", "computing", "calculating", "determining", "analysing" or the like, refer to the action and/or processes of a computer or computing system, or similar electronic computing device, that manipulate and/or transform data represented as physical, such as electronic, quantities into other data similarly represented as physical quantities.

Processor:

[142] In a similar manner, the term "processor" may refer to any device or portion of a device that processes electronic data, e.g., from registers and/or memory to transform that electronic data into other electronic data that, e.g., may be stored in registers and/or memory. A "computer" or a "computing device" or a "computing machine" or a "computing platform" may include one or more processors.

[143] The methodologies described herein are, in one embodiment, performable by one or more processors that accept computer-readable (also called machine-readable) code containing a set of instructions that when executed by one or more of the processors carry out at least one of the methods described herein. Any processor capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken are included. Thus, one example is a typical processing

system that includes one or more processors. The processing system further may include a memory subsystem including main RAM and/or a static RAM, and/or ROM.

Computer-Readable Medium:

[144] Furthermore, a computer-readable carrier medium may form, or be included in a computer program product. A computer program product can be stored on a computer usable carrier medium, the computer program product comprising a computer readable program means for causing a processor to perform a method as described herein.

Networked or Multiple Processors:

[145] In alternative embodiments, the one or more processors operate as a standalone device or may be connected, e.g., networked to other processor(s), in a networked deployment, the one or more processors may operate in the capacity of a server or a client machine in server-client network environment, or as a peer machine in a peer-to-peer or distributed network environment. The one or more processors may form a web appliance, a network router, switch or bridge, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by that machine.

[146] Note that while some diagram(s) only show(s) a single processor and a single memory that carries the computer-readable code, those in the art will understand that many of the components described above are included, but not explicitly shown or described in order not to obscure the inventive aspect. For example, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein.

Additional Embodiments:

[147] Thus, one embodiment of each of the methods described herein is in the form of a computer-readable carrier medium carrying a set of instructions, e.g., a computer program that are for execution on one or more processors. Thus, as will be appreciated by those skilled in the art, embodiments of the present invention may be embodied as a method, an apparatus such as a special purpose apparatus, an apparatus such as a data processing system, or a computer-readable carrier medium. The computer-readable carrier medium carries computer readable code including a set of instructions that when executed on one or more processors cause a processor or processors to implement a method. Accordingly, aspects of the present invention may take the form of a method, an entirely hardware embodiment, an entirely software embodiment or an embodiment combining software and hardware aspects. Furthermore, the present invention may take the form of carrier medium (e.g., a

computer program product on a computer-readable storage medium) carrying computer-readable program code embodied in the medium.

Carrier Medium:

[148] The software may further be transmitted or received over a network via a network interface device. While the carrier medium is shown in an example embodiment to be a single medium, the term "carrier medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store the one or more sets of instructions. The term "carrier medium" shall also be taken to include any medium that is capable of storing, encoding or carrying a set of instructions for execution by one or more of the processors and that cause the one or more processors to perform any one or more of the methodologies of the present invention. A carrier medium may take many forms, including but not limited to, non-volatile media, volatile media, and transmission media.

Implementation:

[149] It will be understood that the steps of methods discussed are performed in one embodiment by an appropriate processor (or processors) of a processing (i.e., computer) system executing instructions (computer-readable code) stored in storage. It will also be understood that the invention is not limited to any particular implementation or programming technique and that the invention may be implemented using any appropriate techniques for implementing the functionality described herein. The invention is not limited to any particular programming language or operating system.

Means For Carrying out a Method or Function

[150] Furthermore, some of the embodiments are described herein as a method or combination of elements of a method that can be implemented by a processor of a processor device, computer system, or by other means of carrying out the function. Thus, a processor with the necessary instructions for carrying out such a method or element of a method forms a means for carrying out the method or element of a method. Furthermore, an element described herein of an apparatus embodiment is an example of a means for carrying out the function performed by the element for the purpose of carrying out the invention.

Connected

[151] Similarly, it is to be noticed that the term connected, when used in the claims, should not be interpreted as being limitative to direct connections only. Thus, the scope of the expression a device A connected to a device B should not be limited to devices or systems wherein an output of device A is directly connected to an input of device B. It means that there exists a path between an output of

A and an input of B which may be a path including other devices or means. "Connected" may mean that two or more elements are either in direct physical or electrical contact, or that two or more elements are not in direct contact with each other but yet still co-operate or interact with each other.

Embodiments:

[152] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinary skill in the art from this disclosure, in one or more embodiments.

[153] Similarly it should be appreciated that in the above description of example embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the Detailed Description of Specific Embodiments are hereby expressly incorporated into this Detailed Description of Specific Embodiments, with each claim standing on its own as a separate embodiment of this invention.

[154] Furthermore, while some embodiments described herein include some but not other features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those in the art. For example, in the following claims, any of the claimed embodiments can be used in any combination.

Different Instances of Objects

[155] As used herein, unless otherwise specified the use of the ordinal adjectives "first", "second", "third", etc., to describe a common object, merely indicate that different instances of like objects are being referred to, and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

Specific Details

[156] In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

Terminology

[157] In describing the preferred embodiment of the invention illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar technical purpose. Terms such as "forward", "rearward", "radially", "peripherally", "upwardly", "downwardly", and the like are used as words of convenience to provide reference points and are not to be construed as limiting terms.

Comprising and Including

[158] In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" are used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

[159] Any one of the terms: including or which includes or that includes as used herein is also an open term that also means including at least the elements/features that follow the term, but not excluding others. Thus, including is synonymous with and means comprising.

Scope of Invention

[160] Thus, while there has been described what are believed to be the preferred embodiments of the invention, those skilled in the art will recognize that other and further modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such changes and modifications as fall within the scope of the invention. For example, any formulas given above are merely representative of procedures that may be used. Functionality may be added or deleted from the block diagrams and operations may be interchanged among functional blocks. Steps may be added or deleted to methods described within the scope of the present invention.

[161] Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

Industrial Applicability

[162] It is apparent from the above, that the arrangements described are applicable to the power monitoring industries.

Claims

1. A distributed power outlet power monitoring system the system comprising:
 - at least one power reporting unit having a power input, a power output, a memory device and a wireless computer data network interface,
 - the power reporting unit drawing operational power from the power input using a power adapter;
 - the wireless computer data network interface configured for sending data across the Internet via a wireless Internet router; and
 - the memory device configured for storing a GUID assigned to the power reporting unit and wireless data communication network authentication credentials;
 - a monitoring server in operable communication with the power reporting unit across the Internet;
 - a client terminal in operable communication with the monitoring server across at least one of the Internet and a GSM networkwherein, in use:
 - the power reporting unit, client terminal and monitoring server are configured for implementing a setup process wherein:
 - the memory device of the power reporting unit is configured with authentication credentials of a wireless network of the wireless Internet router;
 - the GUID is sent to the monitoring server from either of the client terminal and the power reporting unit;
 - the monitoring server is configured for storing the GUID uniquely identifying the power reporting unit and associating the GUID against a user account;
 - the monitoring server is configured for storing at least one alert configuration setting against a user account, the least one alert configuration setting comprising at least one of a messaging destination address for the client terminal;
 - and wherein, during operation, the power reporting unit, client terminal and monitoring server are configured for implementing a power monitoring process wherein:
 - while receiving power via the power inlet the power reporting unit is configured for sending periodic power status messages at a first periodic interval to the monitoring server across the internet via the wireless Internet router;

the monitoring server is configured for receiving the power status messages and associating the power status messages with the GUID;

the monitoring server is configured for detecting the lack of receipt of at least one power status message within a threshold period being at least twice that of the first periodic interval; and

the monitoring server is configured for sending an alert message to the client terminal accordingly.

2. A distributed power outlet power monitoring system as claimed in claim 1, wherein the power reporting unit is configured for generating the GUID in a pseudorandom number.
3. A distributed power outlet power monitoring system as claimed in claim 1, wherein the messaging destination address comprises at least one of an email address and mobile phone number.
4. A distributed power outlet power monitoring system as claimed in claim 1, wherein the monitoring server is further configured for sending a power resumption alert message to the client terminal upon receiving a further power status message from the power reporting unit.
5. A distributed power outlet power monitoring system as claimed in claim 1, wherein the monitoring server is configured for measuring a power outage duration and serving, to the client terminal, a webpage comprising a display of the power outage duration for the power reporting unit.
6. A distributed power outlet power monitoring system as claimed in claim 1, wherein, during the setup process, the power reporting unit is configured for setting up an ad hoc Wi-Fi hotspot.
7. A distributed power outlet power monitoring system as claimed in claim 6, wherein, during the set up process, when the client terminal connects to the ad hoc Wi-Fi hotspot, a browser application of the client terminal is configured to display a landing configuration web page served by the power reporting unit.
8. A distributed power outlet power monitoring system as claimed in claim 7, wherein, during the setup process, the authentication credentials of a wireless network of the wireless Internet router are input into the landing configuration web page and stored by the power reporting unit.
9. A distributed power outlet power monitoring system as claimed in claim 8, wherein, during the setup process, after having received the authentication credentials, the power reporting unit is configured for redirecting the browser application of the client terminal to a URL served by a web server of the monitoring server.

10. A distributed power outlet power monitoring system as claimed in claim 9, wherein, when redirecting the browser application, the power reporting unit is configured for closing the ad hoc Wi-Fi hotspot.
11. A distributed power outlet power monitoring system as claimed in claim 9, wherein the URL comprises the GUID as a URL parameter.
12. A distributed power outlet power monitoring system as claimed in claim 11, wherein, when receiving a request for the URL from the client terminal, the monitoring server is configured for storing the GUID uniquely identifying the power reporting unit and associating the GUID against a user account.
13. A distributed power outlet power monitoring system as claimed in claim 9, wherein, when receiving a request for the URL from the client terminal, the monitoring server is configured for serving a web page to the client terminal requiring the authentication with an existing user account or the creation of a new user account.
14. A distributed power outlet power monitoring system as claimed in claim 1, wherein, when sending a power status message to the monitoring server, the power reporting unit is configured for requesting a URL served by a webserver of the monitoring server.
15. A distributed power outlet power monitoring system as claimed in claim 14, wherein the power reporting unit is configured for including the GUID as a URL parameter when requesting the URL.
16. A distributed power outlet power monitoring system as claimed in claim 1, wherein, when sending a power status message to the monitoring server, the power monitoring server is configured for sending a network ping request to an IP address associated with the power reporting unit.

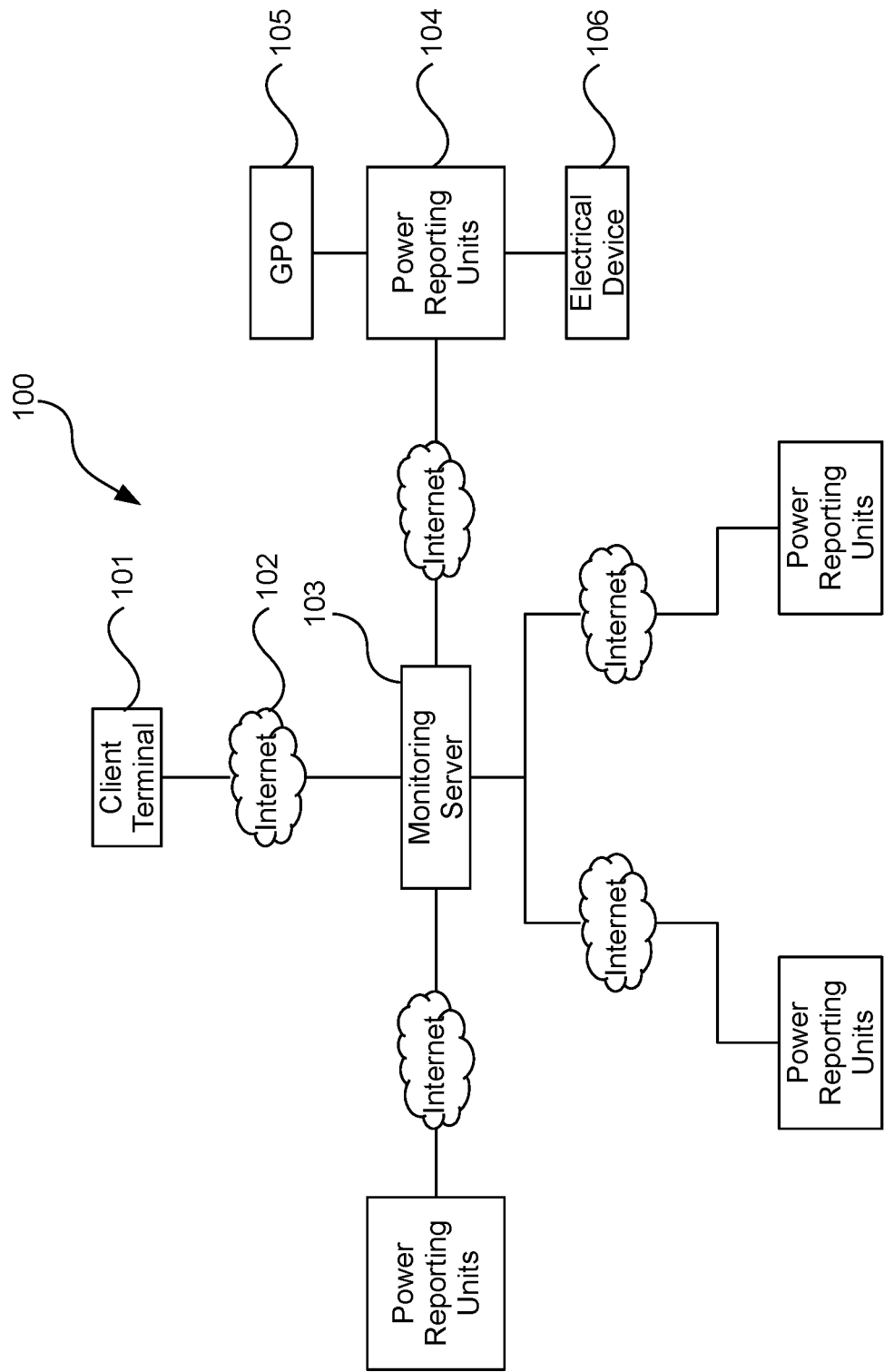


Figure 1

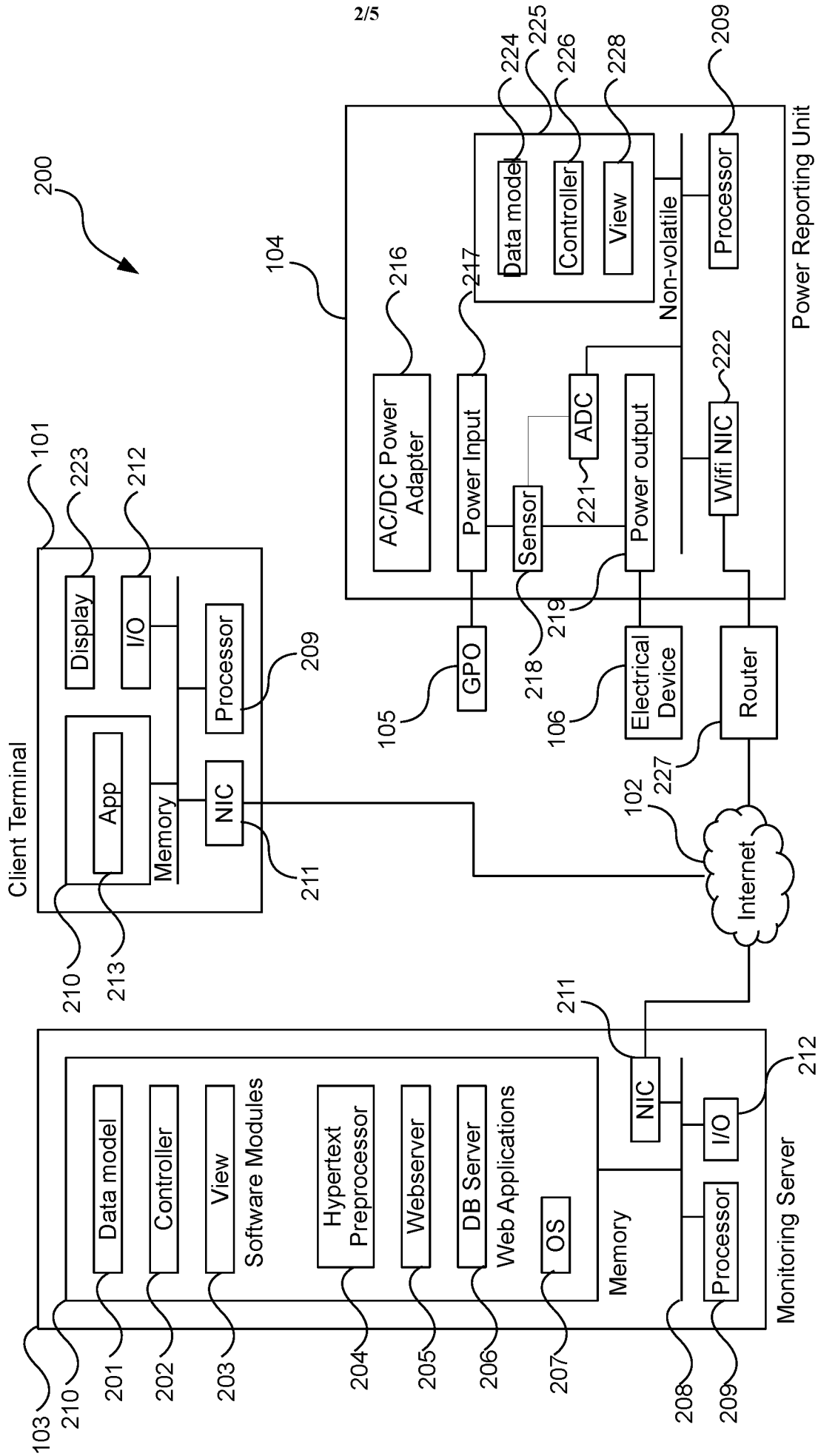


Figure 2

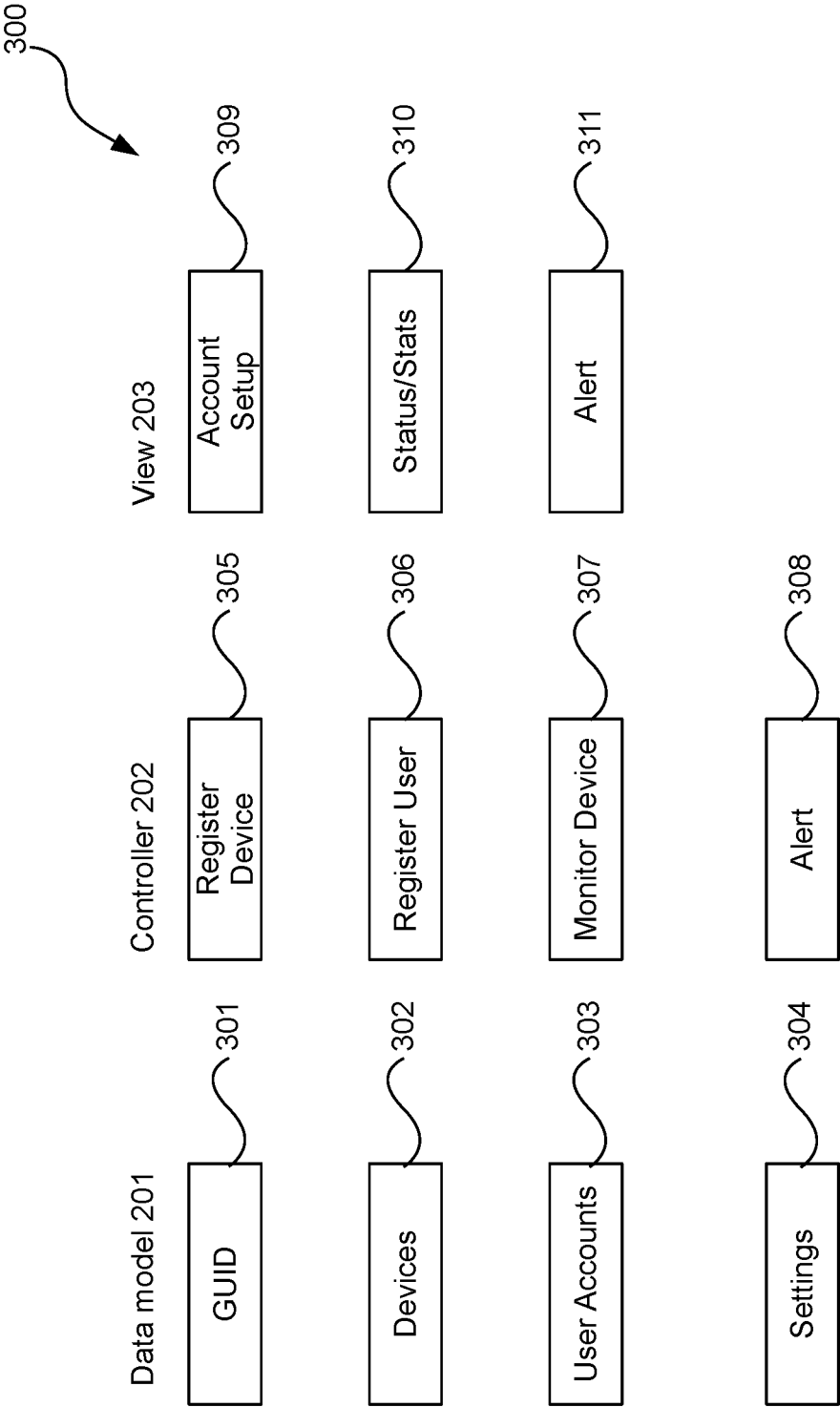


Figure 3

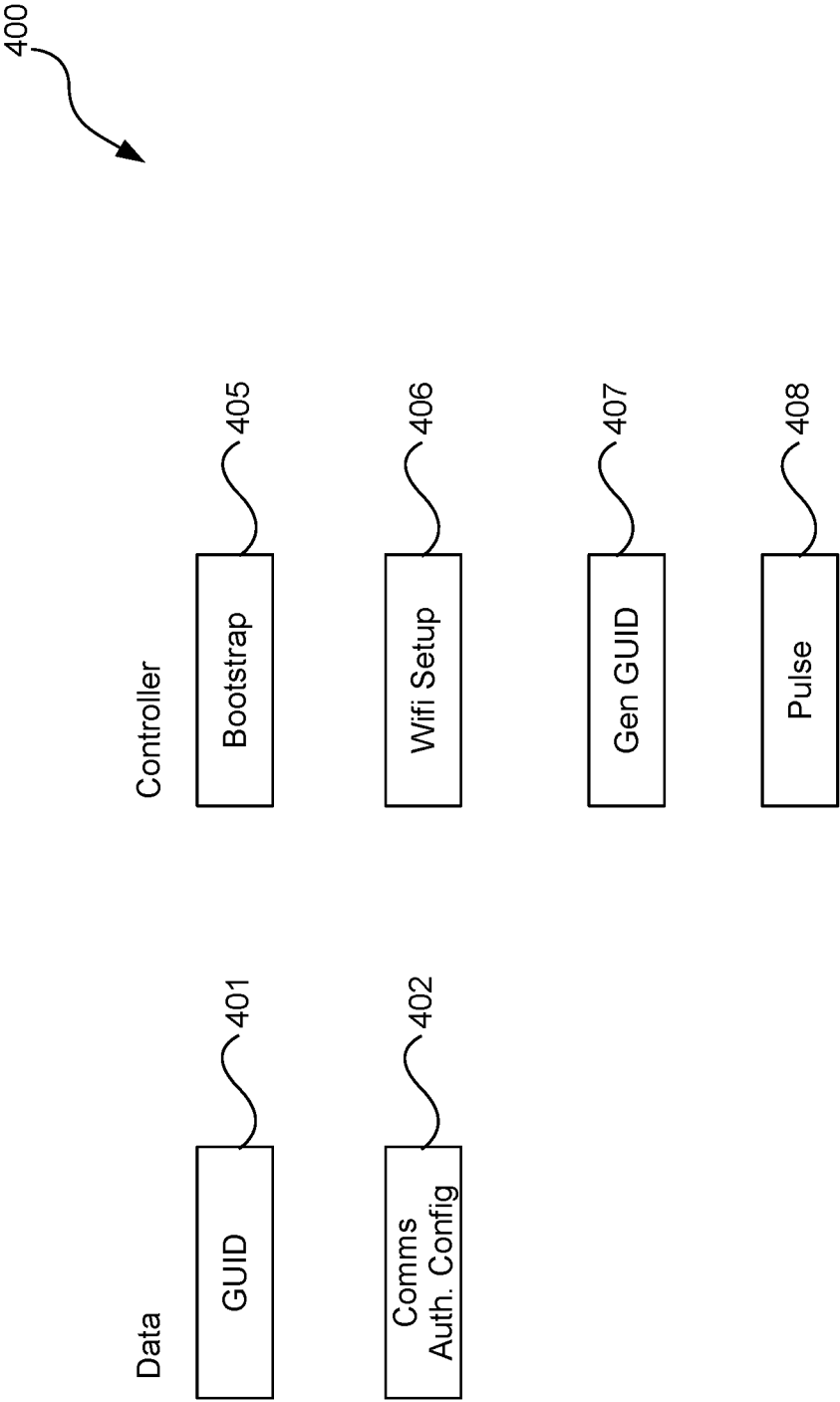


Figure 4

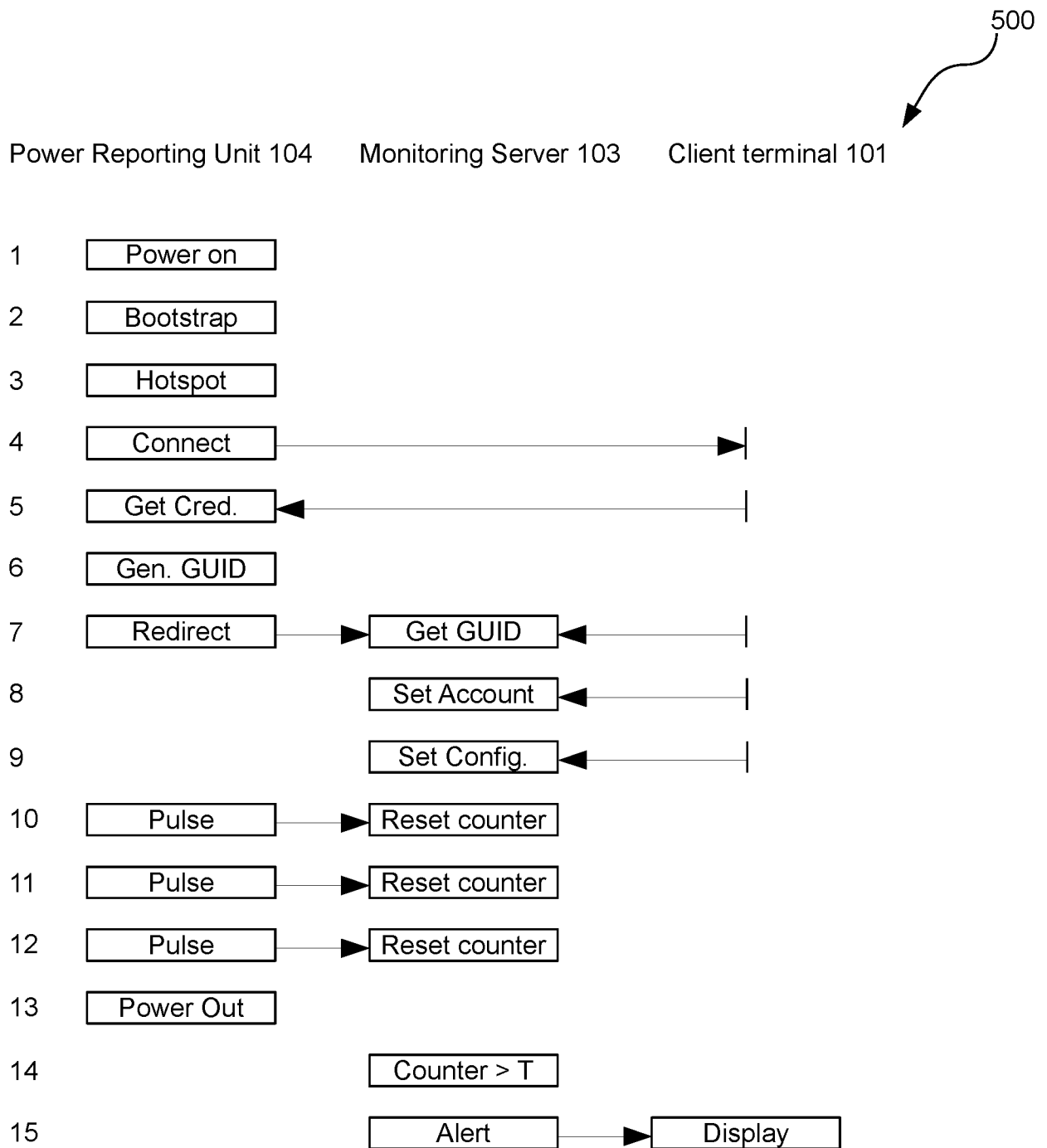


Figure 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2017/050032

A. CLASSIFICATION OF SUBJECT MATTER

H02J 13/00 (2006.01) G01R 19/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases: WPIAP, EPODOC, TXPEA, TXPEB, TXPEC, TXPEE, TXPEF, TXPEH, TXPEI, TXPEP, TXPES, TXPEPEA, TXPUSE0A, TXPUSE1A, TXPUSEA, TXPUSEB, TXPW0EA, INSPEC, Espacenet, Google, Google Images and Google Patents.

IPC/ CPC: H02J13/-, G01R19/-, G08C17/02, G05B23/02/-, H04L12/2825.

Keywords: power, supply, monitor, alert, emails, secure, account, predetermined, threshold and like terms.

Applicant/Inventor Name Search: AusPat, Espacenet and internal databases provided by IP Australia.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 1 May 2017		Date of mailing of the international search report 01 May 2017	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au		Authorised officer Nusrat AHMED SUROBHI AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61-2-6225-6173	

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/AU2017/050032
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0306832 A1 (JONATHAN GOOSE) 16 October 2014 see entire document especially Abstract, Paragraphs 17, 34 - 36, 39, 40, 44, 46, 75 and Fig. 1.	1 - 16
Y	US 2009/0153338 A1 (KOMOSA) 18 June 2009 see entire document especially Paragraphs 8, 16 - 19 and Fig. 1.	1 - 16
Y	US 2007/0139183 A1 (KATES) 21 June 2007 see entire document especially Paragraphs 44, 47 - 49, 51, 52 and Fig.1.	1 - 16
A	US 2013/0024714 A1 (FU et al.) 24 January 2013 see entire document.	
A	US 2013/0091374 A1 (PENG CHEN et al.) 11 April 2013 see entire document.	
A	US 6229450 B1 (MALMSTEN) 08 May 2001 see entire document.	

Form PCT/ISA/210 (fifth sheet) (July 2009)

INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/AU2017/050032	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
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		US 8612792 B2	17 Dec 2013
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		TW 201305571 A	01 Feb 2013
US 2013/0091374 A1	11 April 2013	US 2013091374 A1	11 Apr 2013
		CN 103035301 A	10 Apr 2013
		TW 201316342 A	16 Apr 2013
US 6229450 B1	08 May 2001	US 6229450 B1	08 May 2001
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			