

SYSTEM AND METHOD FOR DISPLAYING MESSAGES IN A BUILDING AUTOMATION SYSTEM

FIELD OF THE INVENTION

The present invention relates to the provision of information in a building environment.

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PRIORITY DOCUMENTS

The present application claims priority from:

Australian Provisional Patent Application No. 2008904107 entitled "SYSTEM AND METHOD FOR DISPLAYING MESSAGES IN A BUILDING AUTOMATION SYSTEM" and filed on 12 August 2008. The content of this application is hereby incorporated by reference in its entirety.

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INCORPORATION BY REFERENCE:

The following publications are referred to in the present application:

- Australian Patent 683529 entitled "Home and Building Electrical Control Protocol";
- 15 - PCT Patent Application No. PCT/AU2004/001052 (WO2005/015774) entitled "Radio Network Communication System and Protocol Using An Automatic Repeater";
- PCT Patent Application No. PCT/AU2004/001053 (WO2005/015811) entitled "Radio Network Communication System and Protocol";
- PCT Patent Application No. PCT/AU2004/001054 (WO2005/015751) entitled "Collision
- 20 Detection in a Non-Dominant Bit Radio Network Communication System";
- PCT Patent Application No. PCT/AU2008/000150 (WO2008/095249) entitled "Selective Communications Network Functionality";
- PCT Patent Application No. PCT/U2008/000151 (WO2008/095250) entitled "Wireless Network Communications System"; and
- 25 - PCT Patent Application No. PCT/US01/00428 (WO 01/52478) entitled "Building Control";

the entire content of each of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Information can be presented in a variety of ways. In some cases information can be concisely summarised into information which is basic or fundamental in nature. For example the base information of a weather report or forecast for a city may be considered to be a temperature and/or a general summary of the conditions such as sunny, rainy or cloudy. The base information in a stock market quote may be considered to be a listing code and a share price. Other examples include the number of new emails in an email account or the result of a football match. Other information is basic or fundamental nature in the sense that it is short and relatively arbitrary in nature. For example a

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thought or joke of the day, or a news headline. Such information may act as a trigger for further research or action, or may enable a person to stay up to date.

- Such basic or fundamental information may enable the recipient to make decisions or to act as a mnemonic, or trigger for further action. For example a recipient can utilise a weather forecast to choose appropriate clothing, or whether to take an umbrella when they leave the house. In some cases such basic information has limited relevance, such as being relevant to a restricted group of people and/or being relevant for a limited time period after its generation. For example a weather forecast will be relevant to a limited geographical area and for a limited time after issuance of the forecast. Also in the case of a weather forecast, a recent forecast for a given day is more likely to be accurate than a forecast issued hours or days earlier. Despite the information being basic information, or of limited relevance, it may often be used by a recipient of the information to make decisions (eg choosing appropriate clothing as discussed above).
- Other basic information may have limited relevance in that it simply alerts a person to a particular event or scenario, and the recipient can then choose whether to take further action in response. For example a news headline may provide a concise summary of a news article, and if it is of interest to the recipient they may then decide to read the entire article. In another example a person may be interested in knowing if any emails marked as urgent have been received overnight. If a person receives notification that an email was received overnight, the person can then choose whether to immediately access an email account to review the content and take necessary action. Alternatively if the person is either not able to access their email at that location, or has other tasks in need of their attention, such knowledge allows them to plan their activities so that they access their email at the appropriate time. Alternatively, knowledge of how many new emails have been received overnight may be useful to the recipient in planning their activities.

Some basic information is relevant to a group of people, rather than a particular person. For example a message left on a home voicemail system may be relevant to any occupant of the house, rather than a specific occupant. Also some home voicemail systems use passive alerting means such as an altered dial tone to alert occupants that a message has been left. Thus on entering a house an occupant must remember to check the telephone to determine if any messages have been left. It can thus be desirable to provide a visual means within the house to alert any occupant of the existence of a message.

A substantial quantity of information is freely available on the internet and may be obtained from a range of sources. However the accuracy of such basic information varies based on the source. Also much of the freely available basic information on the internet is formatted for display in web browsers

and the basic data of interest, such as the forecast temperature is embedded in a much richer information source. A user interested in basic information then has to sort through the wealth of information to extract the basic information of interest. Automated approaches such as those in the form of computational screen scrapers may be used to strip out the basic information from the display intended for a human user. This task is made more difficult due to content providers changing the format of the content, requiring reprogramming or modification of screen scraping programs, this modification is typically beyond the skills of most home owners and would challenge many computer users.

Many houses have computers with internet access, and thus basic information is potentially available to occupants. However such computers are not always left permanently switched on, or at least not left on overnight, due to noise and power consumption considerations. In some circumstances, such as in the morning, or immediately after having a shower, it may not be convenient for a person to sit down in front of a computer and locate a recent weather forecast. Hence a person may be disinclined to use a computer to seek basic information due to the extra effort involved in obtaining the information.

Some television programs, particularly early morning and news programs, provide information in banners scrolling across the screen, or in a fixed location, such as the bottom right corner of the screen. However, the viewer has no control over the information displayed and often relevant information is embedded amongst a stream of related, but irrelevant information. For example weather forecasts may be presented, but on a city by city basis and in such circumstances a user may not wish to wait for the forecast relevant to their city to be displayed. Similarly the person needs to have the television turned on, needs to be close enough to it to see, and needs to be actively watching it.

In some cases a person may subscribe to information services which are delivered to their mobile phone, typically via daily SMS notifications. However as such services are provided over the mobile telecommunications infrastructure they are typically an expensive way to deliver the information. This can act as a disincentive to a person subscribing in the first place. Also such systems rely on the subscriber remembering to check the content on their mobile phone, which are not necessarily left on overnight. Furthermore, the information may be relevant to more than one person in a house, in which case a subscriber must either inform the other persons in the house or send the information to their mobile devices, potentially incurring a further cost. Additional, unnecessary costs are also incurred in the case where multiple members of the same household subscribe to the same information.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a system for preparing and displaying information in at least a portion of a display area of a display capable device, the system comprising:

an information centre, comprising:

a subscriber database wherein the subscriber database comprises a plurality of subscribers and each subscriber has an associated message delivery address;

one or more servers, wherein the one or more servers receive information from one or more sources, extract one or more portions of the received information and send the one or more portions to one or more message delivery addresses in the subscriber database;

a gateway device located at the message delivery address for receiving the one or more portions of information sent from the information centre and providing in one or more messages to one or more of the display capable devices associated with the gateway device; and

one or more display capable devices, each display capable device comprising

a communications interface for receiving the one or more messages provided by the gateway device; and

a display area wherein at least a portion of the display area is used to display a representation of the one or more portions of information in the received one or more messages.

According to a second aspect of the present invention, there is provided an information centre for use in a system for displaying information in at least a portion of a display area of a display capable device, comprising:

a subscriber database wherein the database comprises a plurality of subscribers, each subscriber having an associated message delivery address;

one or more servers, wherein the one or more servers receive information from one or more sources, extract one or more portions of the received information, format into one or more messages, and send the one or more messages to one or more message delivery addresses in the subscriber database.

According to a third aspect of the present invention, there is provided a gateway device for use in a building automation system comprising one or more display capable devices, the gateway device comprising a communications interface and a processor, wherein the communications interface receives one or more portions of information for displaying in a portion of a display area of display

capable devices in the building automation system, and the communications interface sends the one or more portions of information to one or more display capable devices in one or more messages in a predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol,
5 number and description fields, and the gateway device provides the message in the predetermined format to the one or more display capable devices.

According to a fourth aspect of the present invention, there is provided a gateway device for use in a building automation system comprising one or more display capable devices, the gateway device
10 comprising a communications interface and a processor, wherein the communications interface requests information from one or more external sources and the processor parses the received information to extract and format one or more portions of information into one or more messages in a predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol,
15 number and description fields, and the communications interface sends the one or more messages to the one or more display capable devices for displaying the one or more portions of information in at least a portion of the display area of the display capable device.

According to a fifth aspect of the present invention, there is provided a method for generating a message for displaying information in a portion of a display area of a display capable device, the
20 method comprising:

receiving information from one or more sources;
extracting one or more portions of the received information and formatting the extracted one or more portions into a message, the message comprising a header portion and a data portion, the
25 header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and description fields.

According to a sixth aspect of the present invention, there is provided a method for displaying information received in a message in a portion of a display area of a display capable device, the
30 method comprising:

receiving a message;
parsing the received message according to a predetermined format, wherein the predetermined format comprises a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and
35 description fields; and

displaying a representation of the information in the data portion in a portion of display area of a display capable device.

According to a seventh aspect of the present invention, there is provided a display capable device in a building automation system for displaying a received message in a portion of a display area, the device comprising:

- a storage device;
- a communications interface for receiving a message;
- a processor for parsing the received message, the processor operatively coupled to the storage device and the communications interface; and
- a display area wherein at least a portion of the display area is used to display a representation of the information in the received message.

According to a eighth aspect of the present invention, there is provided a system for providing information to one or more devices in a building automation system, the system comprising:

- an information centre, comprising:
 - a subscriber database wherein the subscriber database comprises a plurality of subscribers and each subscriber has an associated message delivery address;
 - one or more servers, the one or more servers receiving information from one or more sources, extracting one or more portions of the received information and sending the one or more portions to one or more message delivery addresses in the subscriber database;
- a building automation system comprising a plurality of devices, wherein the message delivery address corresponds to a device in the building automation system, and one or more devices act upon the received one or more portions of information.

According to a ninth aspect of the present invention, there is provided a gateway device for use in a building automation system comprising a plurality of devices, the gateway device comprising a communications interface and a processor, wherein the communications interface receives one or more portions of information and provides the one or more portions of information to at least one of the plurality of devices, and the one or more devices act upon the received one or more portions of information.

According to a tenth aspect of the present invention, there is provided a device in a building automation system, the device comprising:

a communications interface for receiving a message comprising one or more portions of information obtained from one or more sources external to the building automation system;

a processor for parsing the received message and acting upon the received one or more portions of information.

5 According to a eleventh aspect of the present invention, there is provided a system for preparing and displaying a message in at least a portion of a display area of a display capable device, the system comprising:

an information centre, comprising:

10 a subscriber database wherein the subscriber database comprises a plurality of subscribers and each subscriber has an associated message delivery address;

one or more servers, wherein the one or more servers receive information from one or more sources, and determine one or more sets of instructions for extracting one or more portions of information from the received information and send one or more sets of instructions to the one or more message delivery addresses in
15 the subscriber database;

a gateway device located at the message delivery address comprising a communications interface and a processor, wherein the communications interface receives the one or more sets of instructions and receives information from one or more sources, and the processor extract one or more portions of information from the information received from the one or more sources using the received
20 one or more sets of instructions, and the communications interface sends the one or more portions of information in one or more messages to one or more display capable devices associated with the gateway device; and

one or more display capable devices, each display capable device comprising
a communications interface for receiving a message provided by the gateway device;
25 and

a display area wherein at least a portion of the display area is used to display a representation of the one or more portions of information in the received one or more messages.

30 According to a twelfth aspect of the present invention, there is provided a gateway device in a building automation system, comprising a communications interface and a processor, wherein the communications interface receives from an information server one or more sets of instructions for the processor for extracting one or more portions of information from one or more sources of information, and the processor executes the one or more sets of instructions to obtain one or more portions of
35 information from information received from an external source, and the gateway device sends the one

or more portions of information to one or more devices in the building automation system and the one or more devices act upon the received one or more portions of information.

BRIEF DESCRIPTION OF THE DRAWINGS

- 5 An illustrative embodiment of the present invention will be discussed with reference to the accompanying drawings wherein:
- FIGURES 1A to 1C illustrates several elements and embodiments of a system for displaying a message in a building automation system 100;
- FIGURES 2A to 2C are message formats according to an embodiment of the invention;
- 10 FIGURES 3A to 3E are message formats according to an another embodiment of the invention;
- FIGURES 4A to 4D show displays of messages according to various embodiments of the invention;
- FIGURE 5 shows a representation of new email notification message according to embodiments of the invention;
- FIGURE 6 shows a representation of a display screen of a display capable device according to an
- 15 embodiment of the invention;
- FIGURE 7 shows two representations of successive displays of a display capable device according to an embodiment of the invention;
- FIGURE 8 shows a flowchart of a method for generating a message for displaying information in a portion of a display area of a display capable device according to an embodiment of the invention; and
- 20 FIGURE 9 shows a flowchart of a method for displaying information in a message in a portion of a display area of a display capable device according to an embodiment of the invention.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

- Referring now to Figures 1A to 1C, there are shown various elements and embodiments of a system
- 25 for displaying a message in a building automation system 100. Figure 1A shows an embodiment of building automation system 140 which includes a gateway device 150 which controls external access to the building automation system. The building automation system 140 links display capable devices 170, 172 and control devices 180, 182 (in this case lacking display capabilities) via wired 160 and
- wireless 162 links. The gateway device 150 receives information 102 from sources of information
- 30 external to the building automation system. The gateway device then provides this information in the form of messages to the devices in the building automation system, upon which the devices may act. The devices may include a processor, a storage device (eg Flash memory, RAM, ROM), a communication interface, a display area, and/or control capabilities related to building automation.
- The links between the gateway and the devices may be wired links (as between the gateway 150 and
- 35 devices 170 and 180) or wireless links (as between the gateway 150 and devices 172 and 182). For example display capable devices 170 and 172 could display a representation of the information in a

portion of the display area of the device, and control devices 180, 182 could use the message to perform a control function. Further, if one of the devices in the building automation system has audio capabilities, a sound or a message which is an audio representation of the information could be played by the device in response to receiving the message. Similarly if one of the devices has wireless
5 communications capability such as Bluetooth, a representation of the message could be provided to other Bluetooth capable devices. As will be discussed below, the information received by the gateway device may be information requested by the gateway device, or information sent to the gateway device from an information centre.

10 Figure 1B shows another embodiment of the invention which includes an information centre 110 (or message generation centre) 110 and the building automation system 140 of Figure 1A. Sources of information 120, 122, containing portions of information “#” 124 and “*” 126, send, feed or otherwise provide information to the information centre 110. The information centre includes one or more
15 servers 112 to receive the information. The information is aggregated and processed, and one or more portions of information are extracted (eg pieces of basic information, in this case “#” and “*”). These one or more portions can then be formatted into one or more messages for sending to, or otherwise providing to, a message delivery address, such as over the internet 130. The message delivery address may correspond to a device in a building automation system such as a gateway device. The gateway
20 device 150 at the message delivery address receives the one or more messages and sends or provides the portions of information in the one or more messages to display capable devices 170, 172. The display capable device receives the portions of information and appropriate representations of the portions of information contained in the message are displayed. Depending upon the size of available
25 portion of the display area, some or all of the portions of information received may be represented or displayed, eg “#” in device 170 and “#*” in device 172.

Figure 1C shows another embodiment of the invention which includes an information centre 110 (or message generation centre) 110 which sends information to several subscriber sites. As previously, the information centre receives information from several sources, and extracts one or more portions of information. These one or more portions can then be formatted into one or more messages for sending
30 to, or otherwise providing to, subscribers via a message delivery address. In this embodiment the information centre includes a subscriber database 114 which includes at least one message delivery address associated with each subscriber. For each message, a database of subscribers (the subscriber database) is queried to obtain a list of subscribers who wish to receive the message. The message is then sent to each associated message delivery address over the internet 130. In this embodiment three
35 subscribers request a message, and each subscriber has an associated message delivery address 132, 134, 136, which directs the message to the IP address of the gateway devices 152, 154 and 156 in

respective building automation systems 142, 144, 146. The information sent might be encrypted or unencrypted. In other embodiments the message delivery address may be some other electronic device address associated with a subscriber or target (physical) site. In other embodiments networks other types of message delivery addresses may be used. For example rather than using the internet the message could be sent, or at least partially sent, over other networks or systems such as telephone network using a dialup or digital subscription line (DSL) protocol, over an optical fibre or cable network, over a satellite network, or over a power transmission line network. Various combinations of the above networks may be used to send messages from an information centre to a message delivery address. The message delivery address will be in an appropriate format that allows delivery of the message to the desired address, and thus the format of the address may depend upon the network used to send the message.

The messages sent to the message delivery address (eg gateway device at the subscribers home or building automation system) may be in a predetermined format which includes a header portion and a data portion, the header portion including at least a message type field, and the data portion including at least two fields from the group of symbol, number and description fields. In the following description these messages may be referred to as basic messages, to indicate that such messages contain information of a basic or fundamental nature, or which represents a concise summary, or the base information, of a larger message, document or information source. The gateway device 150 at the message delivery address receives the message and provides the message to devices in the building automation system for acting upon. If the message is sent according to the predefined format known to the display capable devices, then appropriate representations of the symbol, number and description fields contained in the message may be displayed in a portion of the display area of display capable devices at each subscriber site.

In one embodiment the information centre 110 is a central site having one or more servers 112. However, multiple such centres may exist, and a given centre may be functionally distributed and operatively connected over multiple physical sites. Each server includes a processor and either includes or is communication with a storage device. A subscriber database may be maintained by the information centre which includes information on the subscriber such as name, IP or other address, and characteristics of the message delivery service, such as the type and frequency of messages the subscriber wishes to receive. The term database is used broadly and covers both conventional SQL database as well as collections of electronic records such as one or more spreadsheets, or text files which an interface can be written for to provide the required functionality (i.e. storage, updating, and extraction of information relating to a subscriber). Other information such as billing address may also be stored in the database. The information centre may also provide a user interface such as a web

interface to allow existing subscribers to update details and message characteristics or preferences, as well as allowing new persons to subscribe to the service.

5 The information centre receives information from a range of sources 120, 122. The information may be supplied from commercial sources 120, or from freely available (public) sources 122. The incoming information may be in response to a request for information made to the information source by the information centre such as over HTTP or HTTPS. Alternatively an agreement may be established between an information source and the information centre to provide the information to the information centre. In this case the data may be sent periodically or at an agreed time. Information 10 may be sent to the information centre via email, a RSS feed, uploaded to a server via a connection (eg FTP, sFTP, SSH etc), or using other suitable means or data transfer protocols as would be apparent to the person skilled in the art.

15 The information received may relate to a wide range of topics such as weather forecasts or reports, surf forecasts or reports, snow forecasts or reports, stock prices, horoscopes, traffic reports, number of voice-mail messages in an in-box, number of e-mail messages in an in-box, weather warnings, moon phases, tide times, Joke/Thought/Insult/Definition/Poem/Picture of the Day, news headlines, air quality forecasts, sports results and many others. Some topics or information may be relevant to a wide range of subscribers (such as weather forecasts). Other topics or information may be specific to 20 individual subscribers and may require configuration by the subscriber such as via the web interface discussed above. In one embodiment a subscriber could specify an email account to be monitored and the number of email messages in the specified account could be periodically sent to the message generation server.

25 The information considered above is typically only relevant for a limited time period after it is compiled at the source, or after it is sent to the information centre. Additionally the information may only be relevant to a subset of subscribers, such as only to those subscribers in a specific city, or relevant to individual subscribers, such as in the case of email monitoring above. By allowing the subscriber to set their preferences (received message characteristics), they receive exactly the 30 information they want without needing to be concerned with what other subscribers might be receiving and without having to look through other information that may be irrelevant.

The received information is processed by one or more servers 112 of the information centre 110. The information is processed to extract one or more portions of information of interest to subscribers. Such 35 portions of information may be basic information, which as the term basic implies, are the base or fundamental pieces of information relating to a topic. Basic information is typically very short and

succinct, such as a forecast temperature; a forecast condition such as sunny, cloudy or rainy; a message to avoid a certain road (without details of why the road should be avoided). In other cases the basic information may be a concise summary, such as a news headline. The information extracted may be a combination of such basic information, together with more detailed information.

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The servers of the information centre may computationally parse the received information and extract one or more pieces or portions of information, which may be compiled to form a message. A message may combine portions of information from an individual source, or from a range of sources. Various predefined formats may be utilised (these will be discussed below). Information extraction and production of messages may be performed at the time the information is received from a source, at 10 predetermined times (eg every 10 minutes) or at other appropriate times such as that dictated by load scheduling software. Extraction and production functions may be split. For example a software module executing on a server may parse received information and extract information which is stored in the information database, typically along with associated information such as time stamp, period of 15 relevance or expiration time and the data source. A list of alternate sources that equivalent information could be obtained from if the primary or current source is unavailable (or extraction fails). A separate software module executing on the server (or a different server) may access information stored in the information database and compile messages for distribution according to a set of message templates or protocols at specified times.

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Information from commercial sources 120 may be highly specific in nature and supplied in a standardised format (eg XML, RSS, etc), thereby easing the process of parsing and extraction of information. In some cases the information may be provided in a format suitable for direct inclusion in a message or suitable for direct insertion into the information database used to generate messages.

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The large database of subscribers and centralisation of message extraction and production is likely to be more cost effective to subscribers than individual subscribers individually requesting information from a source and the source delivering the information via email or SMS.

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The public internet contains many sources of freely available information 122. Typically this information is only available in a format suitable for graphical display in a web browser, or for computational processing by a computer. In such cases information may be extracted via screen scraping, web scraping or similar programs which computationally parse the received web content. Screen or web scraping programs range from those which convert a graphical pixel display back into the underlying information (such as optical character recognition software), or computational field 35 parsers which parse a HTML, XML, or similar document to extract pieces or portions of information

contained in tags or fields in the document. Such methods require a varying degree of computer power, programming skill and may be error-prone.

Internet robot (bot) software, or web crawling/spidering techniques may also be utilised to seek out and process information on the internet. Such approaches could be used to seek multiple sources of information. This would provide redundancy, but also requires a decision to be made in regard to the order of preference of visiting sites, or how data should be combined.

Public information sources are subject to change without notice. For example the source location (URL) may be changed, the source provider may choose to stop supplying information or begin charging for the information. Data formats may also be changed without notice. Accordingly the information centre may perform regular monitoring of public information sources and the information extraction process to detect and adapt to any such changes.

As an example, a website may provide a web page which includes a list of weather forecasts for a range of cities. The relevant portion of the website may include HTML code such as:

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<!-- Issued at 0322 UTC Monday 11 August 2008 -->
<table border="0" summary="Capital Cities Precip Forecast">
<tbody>
<tr>
<td><a href="/products/IDW12300.shtml" title="Link to Perth forecast">Perth</a></td>
<td title="Maximum temperature in degrees Celsius" class="max alignright">24&deg;</td>
<td>Fine and Sunny.</td>
</tr>

<tr>
<td><a href="/products/IDS10034.shtml" title="Link to Adelaide forecast">Adelaide</a></td>
<td title="Maximum temperature in degrees Celsius" class="max alignright">19&deg;</td>
<td>Cloudy. Chance of a light shower or two.</td>
</tr>

:
</tbody>
</table>
```

A computational HTML parser could parse the HTML code until it detects the table titled "Capitol Cities Precip Forecast". The structure of the table is that each table row (tag "tr") contains a forecast for a city, which the first table data element in the row (tag "td") being the city name, the second table data element in the row is the temperature forecast, and the third table data element is a short précis or

summary of the predicted weather in the city. Thus in the above case the HTML parser could parse the information and summarise to basic information such as 24 degrees and sunny for Perth, and 19 degrees and cloudy for Adelaide. In this embodiment these city names, temperatures and brief forecast descriptions are represent portions of information contained in the webpage. The HTML parser could
5 also extract the date and time the forecasts were issued at and use this to determine an expiration time for the data, such as 1 day later.

This monitoring process may be performed in a fully supervised, partially supervised, or even completely unsupervised (automatic) fashion. For example a human supervisor could compare the
10 information extracted with the source information provided to a web browser. Comparison could also be performed with other information sources to assess the validity or accuracy of the information. Alternatively error monitoring software could be deployed and a human supervisor alerted to errors in information receiving, parsing and extraction software modules. Alerts could be generated in response to specific events or task failures, or in the case of repeated failures to perform a task. Unsupervised
15 techniques could also be utilised to varying degrees. For example in response to an error, the controlling software program could automatically seek out a new source using internet bot software, or switch to an alternative source such as that contained in the information database. This could be performed without supervisor interaction, or whilst the supervisor is checking the original source of errors. The choice of conditions under which errors are reported, and when information sources are
20 changed, may be made based on operation concerns, such as criticality of the service (eg number of subscribers requesting the information), availability of alternative sources, centre staffing levels, etc.

The information may also be obtained from commercial (ie paid) information providers 120. Such information is typically provided in predefined computer-friendly formats eliminating the more error-
25 prone special processing required for free information sources. Also service providers will typically forewarn customers (ie the information centre) of any change to the service, thereby allowing the information centre to make the necessary changes to its systems and thus handle the change when it occurs.

30 Once information is obtained, a message containing the information must be produced and sent to subscriber addresses (or message delivery addresses) for display on subscriber display capable devices, or to enable devices in the building management system to act. The information centre may utilise a range of message protocols for including and sending the information, provided they may be understood by at least the subscriber's gateway device. The information centre could format the
35 extracted portions of the received information into one or more messages having a predetermined format suitable for use by the subscribers display capable devices. Alternatively, the information

centre could provide the extracted portions of information to the gateway device (such as via TCP/IP packets), and the gateway device could then format the received information into one or more messages having a predetermined format suitable for use by the subscribers display capable devices.

5 A message may be produced according to a predetermined format (or protocol) known by the information centre (or gateway), and the display capable devices. The predefined format may include a header portion and a data portion. In one form the header portion includes at least a message type field, and the data portion includes at least two fields from the group of symbol, number and description fields. The message type field may indicate the type of information contained such as a
10 weather forecast or new email notification. It may also be used to indicate the format of the message such as the type and length of fields included. In one embodiment a message type 1 may indicate a forecast comprising the temperature in the number field and a short description of the weather such as cloudy. A message type 2 may indicate a forecast comprising the temperature in the number field, short description of the weather such as cloudy and a symbol such as cloud, or a code in a symbol field
15 for use in a lookup table on the device to determine the symbol to be displayed (ie 1 corresponds to a cloud, 2 corresponds to a grey cloud, 3 corresponds rain and 4 corresponds to a sun).

In one embodiment, a message protocol may be defined and used by the information centre (or the gateway) and target display capable devices. The message protocol definition defines a plurality of
20 fields for the header and data portions. These include at least definitions of message type, symbol, number and description fields. A range of protocol versions may also be defined, in which a protocol version field is included to indicate what protocol version the message complies with, or was produced in accordance with. The different protocol versions may include different combinations of fields, additional fields, or possibly different length fields. Protocol versions may also be backwardly
25 compatible, in that a higher version number contains all of the information of the preceding version numbers. The use of protocol versions allows the system to cater for range of devices with different processing and display capabilities. In this case the message type field may be used to provide context for the information in the data portion, such as for use with the symbol field to determine the symbol to be displayed.

30 In one embodiment, message protocol version 0 defines the ordered set of protocol version, message type, symbol and number fields as indicated at 200 in Figure 2A. The protocol version field 202 is a 4 bit field 212 allowing 16 different protocol versions. The message type field 204 is a 4 bit field 214 allowing 16 different message types. The symbol field 206 is a 4 bit field 216 allowing 16 different
35 symbols for each message type. The number field 208 is a 4 octet (byte) field 218, allowing 4 characters from the ASCII or another 8 bit alphabet, or 2 characters from the UTF-16 (Unicode

Translation Format) or another 16-bit alphabet. Protocol version 1, 220, is based on version 0, but with the value of the protocol version set to 1 and further includes a description field 222 as indicated in Figure 2B. The description field 222 is 24 octets (bytes) wide 232 allowing 24 characters from the ASCII or another 8 bit alphabet characters, or 12 characters from the UTF-16 (Unicode Translation
5 Format) or another 16-bit character alphabet. Higher protocol numbers could contain extension or additional fields. Thus in this embodiment protocol version 2, 240, is based on protocol version 1 but with the value of the protocol version set to 2 and further includes an extended description field 242 consisting of further 24 octets 252, giving a total combined description field of 48 octets, as is indicated in Figure 2C.

10 In another embodiment, higher protocol numbers could be used for various combinations of fields, of various sizes. In this embodiment, message protocol version 0, 300, defines the ordered set of protocol version, message type, symbol and number fields as indicated in Figure 3A. The protocol version field 302 is a 4 bit field 312 allowing 16 different protocol versions. The message type field 304 is a 4 bit
15 field 314 allowing 16 different message types. The symbol field 306 is a 4 bit field 316 allowing 16 different symbols for each message type. The number field 308 is a 4 octet (byte) field 318, allowing 4 characters from the ASCII or another 8 bit alphabet, or 2 characters from the UTF-16 (Unicode Translation Format) or another 16-bit alphabet. Protocol version 1, 320, is based on protocol version 0 but has protocol version field 302 set to 1 and with the 4 octet number field 306 replaced with a
20 description field 322 which is 24 octets wide 332, as indicated in Figure 3B. Protocol version 2, 340, combines protocol versions 0 and 1, having both a 4 octet number field and a 24 octet description field but with having protocol version field 302 set to 2 as shown in Figure 3C. Protocol version 3, 360, is based on protocol version 3 but has protocol version field 302 set to 3 and the description field 322 is defined as 48 octets wide 372 as shown in Figure 3D. Protocol version 5, 380, is based on protocol
25 version 2, but has protocol version field 302 set to 2 and defines a 1 octet field 392 for message type 304 and a 1 octet field 394 for the symbol field 306, thus providing 256 message types and 256 symbols (either total or per message type) and is shown in Figure 3E.

30 These embodiments are by no means limiting of the size, nature, or type of fields present. It would be quite suitable to omit some fields or portions in some cases or to change the sizes of the fields or portions depending the nature and circumstances of the information to be conveyed and the type and nature of the building automation system being used to convey the information.

35 To further illustrate aspects of the present invention, Figure 8 shows a flowchart of a method 800 for generating a message for displaying information in a portion of a display area of a display capable device according to an embodiment of the invention, and Figure 9 shows a flowchart of a method 900

for displaying information in a message in a portion of a display area of a display capable device according to an embodiment of the invention.

5 In Figure 8, the method 800 begins at step 810 with a device, such as an information server or a gateway, receiving information from one or more sources. At step 820 the device extracts one or more portions of the received information. The device may then, at step 830, format the extracted one or more portions into a message, the message comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and description fields. Finally at step 840, the device may proceed
10 by extracting one or more addresses from a subscriber database and sending the message to each of the one or more addresses.

In Figure 9, the method 900 begins at step 910 with a display capable device in a building automation system receiving a message, such as one sent from a gateway device or from an information server.
15 The display capable device, at step 920 then parses the received message according to a predetermined format (such as that used in step 830 of Figure 8), wherein the predetermined format comprises a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and description fields. Once the display capable device has extracted the portions of information contained in the received message then at step 930 the display capable device proceeds by displaying a representation of the
20 information in the data portion in a portion of display area of a display capable device.

Typically the description field is a text field. Other protocol versions could specify a language field containing a code to define the appropriate alphabet used for the description field. Another set of
25 protocol versions could be used to indicate that the description field is actually a bitmapped image.

The approaches described provide flexibility in the system thus allowing for different classes of devices to be defined based on which versions of the protocols they are capable of understanding. If the protocol versions are defined so that additional fields or information are concatenated to the end of
30 the message, then a device will be able to extract and display at least the information comprising the highest level of the protocol that they understand from a message sent in a higher protocol version. In this way the most resource constrained devices such as those only capable of interpreting and/or displaying protocol level 0 messages would simply ignore any extra data in a message and only display the minimal information associated with protocol 0 fields. In another alternative embodiment
35 devices could adapt or choose the protocol version or set of versions that may be utilised to process and display messages on the basis of the size of the currently available display area.

Additional processing at the time of message generation, and by devices capable of understanding higher protocol versions may be required in these cases, as information may need to be split and recombined across multiple fields. Additional fields could be included to indicate how an extended message is to be composed from a message split over several fields. For example, the primary description and the description extension fields may simply be concatenated. Alternatively the description extension field may completely replace the primary description field. In another alternative embodiment the extension field may be inserted in the middle of the primary description field, in which case additional fields may be required to instruct the processor of where to insert the additional information. Other variants and embodiments will be apparent to the person skilled in the art and are within scope of the invention.

Defining a message protocol allows the development of software and hardware for processing which may be installed in display devices, and reduces the computational burden required for processing and displaying devices. In one embodiment devices with limited processing, storage and display capabilities could include software or hardware allowing it to process protocol 0 messages, and either ignoring all other versions. In devices with large display areas, the available space for displaying messages may change depending upon the amount of display area required for displaying information associated with the primary function of the display (such as lighting control). Software executing in the device could check the available space for displaying a message, and then choose the appropriate message protocol to be used, typically using higher protocols and larger messages when more space is available.

The message type field may be a binary number or code corresponding to one of a set of known message types such as weather report, surf report, snow report, stock report, email notification, meeting notification, voicemail notification, reminder, general message, generic message, etc.

For each message type, a range of symbols representing different states, conditions, or content may be defined. The symbol field stores the binary number or code corresponding to the predefined symbol associated with the message type. For example if the message type was a weather report, the range of symbols may include the sun, clouds, and rain and the sun symbol being used when the forecast was for sunny weather. In the embodiments of a message display shown in Figures 4A and 4B, the symbols corresponds clouds and the sun, indicating cloudy and sunny weather respectively.

Through association of the symbol field with the message type field, the same value may be used to designate a range of symbols based on the value of the message field. For example a symbol code of 1

may correspond to the sun in the case of a weather report, and correspond to a large wave in the case of a surf report. This approach reduces the required field size for the symbol field. For example if the message format of Figure 2A is used, a 4 bit message field and 4 bit symbol field would allow 16 symbols per message type, giving a total of 256 symbols to be displayed across all types.

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In another embodiment symbol code could be independent of the message type. For example symbol codes 1-3 may represent sun, rain and clouds, and symbols 4-6 may represent large waves, small waves and no waves (horizontal line). In this case more bits may be required to represent the symbol field if a large number of symbols are required, although symbols may be reused in the case that message types are related.

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A standard set of symbol representations and associated symbol field values and/or message type values may be defined, and stored by the display capable device, thereby allowing a symbol field in a message to be converted to a display symbol. The information centre or gateway device may thus simply specify a standard representation to be used, and the display capable device can be preloaded with an appropriate or customised symbol based upon the device capabilities which correspond to the standard symbol.

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The number field can be used to encode a number relevant to the information contained in the message. In the embodiments of a message display 402,404,412,414 shown in Figures 4A to 4D, the number corresponds to the temperature, and in the display shown in Figure 5, the number corresponds to the number of new messages received in the nominated account.

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The description field can be used to store a short string of text to be displayed. For example in the case of the weather forecasts 412 414 shown in Figures 4C and 4D the words "Cloudy" and "Sunny" are a basic summary of the forecast (along with the temperature). The description field can also reinforce the symbol, or provide additional context. Thus a symbol of the sun could be shown to indicate sunny weather, but the text could state "Change Developing" to indicate that the Sunny weather is due to change. Figure 5 presents an embodiment of a message for new email notification 500, and includes a new mail symbol 502, the number of new mails, 504, and the email account name "username@mail.com.au" 506. Thus the description field 506 provides the context, in this case the email account, for which new mail has been received in.

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Similarly if devices in the building automation system include audio capabilities, then messages could be represented aurally, or aurally and visually. The above message formats described could be modified to include an audio signal which may be played by the device, or the device could include preloaded

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messages and/or speech synthesis. For example the device could be loaded with various weather descriptions and numbers such that the device could generate an audio description of a message (“eg “Forecast Sunny 24 degrees”. In some cases, devices could perform control functionality in response to a received message. For example the air conditioning could be turned on if the forecast temperature was above a threshold temperature. Similarly a hard disk recorder could record a television program if a message was received that a favourite television program was being broadcast that day.

Subscribers may nominate the type of messages they wish to receive. The servers 122 in the message generating centre then generate messages according to various message protocols described above.

10 The choice of protocol may be made based on knowledge of the devices, and specifically the protocol versions that the devices understand. Alternatively, a default protocol version (such as version 0) may be utilised, or multiple versions of the same information may be sent. One or more messages destined for a subscriber are sent at nominated times to the subscriber’s nominated address 140 where they are received by the gateway device 150. These messages may be sent via the internet 130, or over a

15 dedicated or secure link from the message generating centre to the gateway. The messages may be encapsulated in conventional IP packets, or some other mutually agreed form. This form could bear a resemblance to the form of the information transmitted over the building automation system, though this is by no means required, provided the gateway is capable of performing the transformation or reformatting between the different communication protocols. Similarly the information centre could

20 provide information to the gateway device, and this device could format the information, or reformat the information based upon the capabilities of the devices in the building automation system.

Typically the building automation system comprises elements of devices used for control (such as switches, buttons, knobs, dials, touch screens, and so on) and devices used for performing operations

25 (such as but by no means limited to dimming lights, opening a door strike, scanning an access token). These devices are linked to each other using fixed wiring or radio signals, and communicate with each other by sending commands in a well-defined protocol. The exact nature of the protocol is unimportant provided that it allows extension to add the ability to transmit the messages to all of the devices. Naturally, it will be understood that devices which do not understand a message they receive will

30 simply discard it. The protocol may also be defined so as to allow some devices to act in response to received messages. For example a user could specify conditions for which certain acts should be performed (heating, cooling, opening blinds etc), and if an associated message is received (eg weather forecast), a device may act in response.

35 The various aspects of the present invention may thus be used in a variety of systems, such as those described in Australian Patent 683529 entitled “Home and Building Electrical Control Protocol”, PCT

Patent Application No. PCT/AU2004/001052 (WO2005/015774) entitled "Radio Network Communication System and Protocol Using An Automatic Repeater", PCT Patent Application No. PCT/AU2004/001053 (WO2005/015811) entitled "Radio Network Communication System and Protocol", PCT Patent Application No. PCT/AU2004/001054 (WO2005/015751) entitled "Collision
5 Detection in a Non-Dominant Bit Radio Network Communication System", PCT Patent Application No. PCT/AU2008/000150 (WO2008/095249) entitled "Selective Communications Network Functionality", PCT Patent Application No. PCT/U2008/000151 (WO2008/095250) entitled "Wireless Network Communications System", and PCT Patent Application No. PCT/US01/00428 (WO 01/52478) entitled "Building Control", previously incorporated by reference.

10 In a further embodiment the various aspects of the present invention may also be interfaced with power line communications system, whereby devices in a building may be controlled by modulating signals on the power lines within and/or supplying the building.

15 The gateway device forms an interface element between the outside networks of a premise, and the internal networks used for the building control or automation. The precise nature of the gateway is unimportant provided the gateway device includes a communications interface which allows the gateway device to communicate on both networks, and the gateway device includes a processor to enable the gateway device to perform whatever level of protocol conversion or interpretation is
20 appropriate. The gateway device may include storage devices (eg Flash memory, RAM, ROM, hard disks, etc). In some cases the gateway may also perform some level of access control to ensure that only authorised users can access it from outside the building such as by the public internet. The gateway may also optionally allow an authorised user to perform other control and monitoring functions, for example, to check the state of the building security system, to control lighting, or even
25 to display images from cameras located in the building. The gateway device may also allow a bidirectional link to be established with an information centre, to enable provision of messages and user preferences from the building automation centre to the information centre.

Typically installation does not require any special wiring or setup operation, allowing the gateway to
30 be a low cost device which can be simply installed and forgotten. A web interface for configuring the gateway may also be provided, which enables reconfiguration as required.

Setting up the gateway device typically requires informing the gateway device of the automation system (such as a port, device or IP address), and access information for the information centre (such
35 as the IP address or addresses of the centre).

The gateway device may be dedicated device, or a conventional internet gateway devices used for connecting a home computer to the internet. In the case of a dedicated gateway device, this may be directly connected to the internet via a telephone line, or cable, an ISDN line, a leased line, a dedicated network circuit or connection, or wireless means such as WIFI, or other means. Alternatively it may be connected to a port of an existing gateway or modem (wired or wireless) and utilise a pre-existing connection to the internet at the subscribers site (delivery address). Alternatively, the gateway functionality may be incorporated into a convention internet gateway device located at the subscriber's site (delivery address). This functionality may be via additional hardware, firmware or software. In this case the building automation system requires a connection to the gateway device which may be a wired or wireless connection.

In some embodiments, the gateway device may perform some or all of the functionality of the information centre, with user configuration available via a user interface to the gateway device. The user interface may be a web interface accessible via a wired or wireless computing device (eg desktop PC, laptop, mobile phone, PDA etc), and this terminology will be used for convenience. The user could use the web interface to configure RSS feeds which the gateway device could then obtain, reformat, and provide to the local display enabled devices. For example a RSS feed from an online newspaper could be used to provide news headlines to local display enabled devices. Similarly the web interface could allow the user to specify an email account to monitor, and the gateway device could provide information such as number of new emails, along with sender email addresses and subject titles for use by devices with additional display area.

The gateway could perform requests for information based upon requests or information from devices in the building automation system. For example a refrigerator may include a display capable device (connected to the building automation system) which monitors the contents of the refrigerator, such as the amount of milk. If the amount drops below a certain threshold (eg 1 carton) a warning or information message could be sent to the gateway device. Alternatively the refrigerator could routinely report its contents to the gateway, and the gateway could compare the contents with list of minimum quantities and so determine that the amount of milk was low. The gateway device could then request information on the best price for milk from the information centre, or attempt to obtain this information itself, such as using a list of supermarket websites and parsing instructions obtained from an information centre. The best price for the milk could then be displayed on the fridge along with a symbol indicating low milk, and the supermarket with the best price. This approach could be extended to a range of goods or other services. For example, a device associated with a Television could determine that a certain program was routinely watched each week by a viewer. In this case the gateway could use this information and check an online television guide so that a message could be

provided to a device in the house to remind the user about the program and the channel and time of broadcast.

The web interface of the gateway device could be used to configure the gateway to direct different
5 messages to different display devices. For example two occupants may have two email accounts which are monitored, and the gateway web interface would allow specification of which device messages relating to the email accounts are sent to (eg account 1 to display device in bedroom 1 and account 2 to display device in bedroom 2).

10 Further the user or web interface of the gateway device could be used to communicate with the information centre. This may allow the user to subscribe to services or messages via the web interface to the gateway. Alternatively the gateway device could store users IDs, and provide these to the information centre so the messages may be sent to a user's location when travelling. Storing user IDs may also be used to allow customisation of messages to local display devices as discussed above.

15 In some embodiments, the information centre may act as a central update site which pushes out metadata to the gateway (or other internet capable device in the building automation system which for simplicity will be referred to as the gateway device or more succinctly the gateway) which includes information on where the gateway should obtain information, and how any received information may
20 be parsed. In some embodiments, the information centre may provide some portions of information, such as that obtained from propriety systems, as well as metadata on how to extract other portions of information from public websites. The information centre could monitor information sources (eg websites) and produce metadata which contains computer instructions for processing and extracting portions of information contained in the website. This metadata can then be provided to gateway
25 devices which can interpret and execute the instructions in the metadata. As websites or information sources change, updates can be posted out to gateway devices. Alternatively gateway devices can request updates from the information centre. As would be apparent to the person skilled in the art, this approach of providing metadata for constructing a software program represents good design practice and is both flexible, scalable and tailorable into the future as device capabilities develop and as the
30 system grows.

In some embodiments the gateway device may perform all the functionality of the information centre and a gateway, and the information centre may be dispensed with. The gateway device could source information and parse the information to extract and format portions of information for providing to
35 devices in the building automation system. In some embodiments the gateway device could also obtain

information directly from propriety or commercial information systems provided suitable subscriber identification information is provided to allow billing to be performed.

5 A suitable gateway device is the Clipsal C-Bus 5200PG WISER home controller, which allows remote access, control and monitoring of the automation system in a home. This device also allows remote re-programming or commissioning of the automation system devices, as well as the distribution of basic messages, containing basic information as described herein.

10 As will be understood, the gateway device is any interface device connecting the one or more devices within the building to the outside world, and may interface with incoming information in all forms including via internet, wired or wireless links, power line, optical means, satellite and cable and any combination of these.

15 In another alternative embodiment, a message could also define a target device address in a building automation system. This would allow messages to be directed to specific devices, such as those in each bedroom of a dwelling allowing personal customisation of messages to individual occupants at a subscriber site. Such customisation could be done via web interface discussed above. The gateway device could maintain a map of device ID's and nicknames (eg Device 001 = bedroom 1) and provide this nickname to the information centre for association with the message. The message protocol could
20 include a device address field which the message generating centre could utilise when sending a message. This could be used by either the gateway device or the building automation system to ensure delivery of the message to the specified device.

The building automation system 160 could be any system, wired or wireless, suitable for linking the
25 various elements 170, 172, 180, 182 of the building management or automation system. This might be a high or low speed bus, a serial multi-drop bus, an Ethernet, a wireless control network, a power line carrier network, or any other similar network capable of linking the control devices to the internet gateway. Wireless links could be provided using a range of wireless protocols or standards such as Bluetooth, Wi-Fi, IEEE 802.11, C-Bus, etc. The Clipsal C-Bus system is an example of a suitable
30 building automation system.

Elements in the building automation system may be individual devices, or subsystems. Devices (whether individual, or as part of a subsystem) can be broadly divided into those without display capabilities, such as dedicated control devices, 180, 182, and those with display capabilities, 170, 172.
35 Display capable devices may have either display and control functions, or simply display status information on devices or systems. Suitable devices and subsystems include security systems, access

control systems, lighting dimmers, lighting relays, air-conditioning systems, air conditioning thermostats, temperature sensors, light level sensors, movement detectors, refrigeration control systems, or similar. The nature and function of such devices and systems is not particularly important, provided that the information being distributed from the internet gateway 150 has no effect on the
5 otherwise normal operation of these devices, subsystems, or the complete building automation system 160.

Display capable devices 180, 182 in building automation systems typically contain a small graphical (i.e. pixel based display) screen and are often sized to fit into the size and mounting arrangement of a
10 conventional domestic light switch. Such displays are used to display the status of, and allow control of the operation of the building automation system and its various devices. Typically such devices need to have only small screens with dimensions of a few centimetres, with very small processing capacities, and non-volatile memory. Such devices are already available from Clipsal Australia, such as the Clipsal 5055DL which features a backlit 64 x 128 pixel LCD screen and may be used for
15 lighting control. Such devices are low enough in cost to allow installation into every room of a house. Such devices may receiver use input via buttons (eg device 170 in Figure 1) and/or touch screens (device 172 in Figure 2).

The addition of only a small amount of additional software allows these ubiquitous devices to be
20 rendered capable of using all or a portion of their graphical screens to show information such as basic information. Such software handles reception of a message, and parsing of the message into the various fields, and the display of the message. Additionally it may handle multiple messages, and include code to switch between different messages (such as after displaying a message for a specified time), as well as interact with other software executing on the device, so as to determine the amount of
25 available display area to be utilised for a message. Variations allow messages to be sent which allow audio representations or to allow control devices to act in response to the received information.

The protocol versions that a given device is programmed to interpret (and display) may be based on the processing, memory and display capabilities of the device. Typically devices are most constrained
30 in respect of the available display area and resolution, and thus may be able to interpret more complex messages than they are able to display. The software loaded may include a number of predefined symbols or symbol representations - either specific (that is associated) to a message type, or being generally useable by any message type. The exact number stored will vary based on the memory capabilities of the devices, with a typical device storing at least 6 to 12 distinct symbols. In some
35 embodiments, the symbols stored may be updateable, and could be provided to the device based upon the type of messages the user has subscribed to. For example when a subscription is added or

modified, then the server or the gateway device could replace and/or load new symbols associated with these changes. The software may interact with the display software on the device to determine the available area for display, and chose the appropriate message protocol to use, or information fields to display, based on such information.

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Various approaches may be used to display more information that the display is physically capable of displaying at any one instant in time. For example the display of multiple messages could be handled by displaying each message for a specified time (eg 10 seconds) and continuously cycling between the messages to be displayed. An individual message could be split, such as based upon fields in the data portion, and sequential representations could be displayed. In another alternative embodiment, a scrolling type display could be used in which characters enter from the left of the screen and are moved across to the right hand side or vice versa in a timely manner to facilitate display of a long message (that is longer than the width of the display). This effectively splits the message into a series or plurality of sequential representations. Various other techniques for splitting and/or displaying long or multiple messages will be apparent to the person skilled in the art.

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In some embodiments, building automation systems may utilise display capable devices with comparatively large display screens compared to those discussed above. One such device is the Clipsal C-Touch Colour Touch Screen. However in many cases the bulk of such displays is reserved for building automation functions with only a small region available, or reserved, for providing basic messages.

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Figures 6 and 7 illustrate two display capable devices in building automation systems which have been sent two basic messages according to protocol version 0, the first having a message type corresponding to a weather forecast, a symbol field corresponding to a grey cloud, a number field representing the forecast temperature of 19 degrees Celsius, and the second message having a message type of "New Emails", a symbol representing an email (letter), and a number field of 4 representing 4 new messages in an email account.

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Figure 6 shows a display capable device 600 in a building automation system which utilises a touch screen 610 for displaying both messages in a short format. In this embodiment the display is divided into various regions corresponding to locations 620, functions 630, status icons 640, widget interface region 650, and message region 660. The location region 620 includes selectable icons which allow the user to access to controls associated with various locations within the building, such as the kitchen, lounge, dining room, bedrooms and outside areas. The functions region 620 includes selectable icons which allow the user access to controls associated with various functions associated within the

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building automation system, such as lighting, security and temperature. Status icons for displaying system health or web connectivity may be displayed in that status icon region. The widget interface region 650 allows the user to control devices associated with a selected region or associated with a specific function. In the embodiment illustrated in Figure 6, an array of controls are displayed for controlling light levels in various rooms such as the kitchen, porch, lounge, dining, and bedrooms 1 and 2. Other lighting controls may be accessed via navigation buttons such as previous (or prev) and next. A message region 660 may be used to display system messages, and any basic messages sent to the device. In this embodiment, the system date and time maintained by the device is displayed 662, along with a representation of a cloud and the number 19 representing the first message 664, and a representation of a letter and the number 4, representing the second message 666.

If the first and second messages were sent according to protocol version 3 described above, then additional information provided in the description field, or possibly in a plurality of description fields if the original information was split over several messages, may be available to the device. In the present embodiment, the first message may contain a more detailed weather forecast for the day, and the second message may include the email addresses of the senders and/or the subject lines of the new emails. The user could access or view this information by touching the appropriate icon, with the widget interface region 650 being used to display the additional information (ie that contained in the description fields of the messages).

Figure 7 shows two representations of successive displays of a display capable device 700 with a smaller display screen than the display capable device 600 in Figure 6. In this embodiment the display capable device includes a plurality of buttons for controlling devices in the building automation system. In this embodiment, the display area is limited so that only messages according to protocol version 0, as discussed above, may be displayed. In order to display the two messages, the device switches between a first display 710, used for representing the first message, and a second display 712 used for representing the second message. In the absence of the user pressing a button, the device regularly switches between each display, for example switching every 10 seconds.

The first display 710 displays lighting levels in the kitchen 720, lounge 730, bedroom 1 740 and bedroom 2 750. The lighting level associated with each room is displayed via a line with end markers representing 0% (off) and 100% (full) intensity, with a vertical bar indicating the present illumination level. Lighting levels associated with each room may be controlled by buttons 722, 732, 742 and 752. The lower portion of the display also includes a message and navigation region 760, and associated navigation button 762. This region displays the system time 762 (7:42), a navigation icon 764 (right arrow) associated with navigation button 762. Pressing the navigation button 762 causes the device to

display another page of controls for controlling other devices in the building automation system. This region also includes a representation of a cloud and the number 19 representing the first message 766. The second display 712 is similar to the first display, but in this display the message and navigation region includes a representation of a letter and the number 4, representing the second message 768.

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Messages may be given a finite life via a validity period or expiration time, with control handled either by the device, or via the building automation system, or even the information centre. For example a message could include an expiration or time field, which would specify the time the message was valid until, after which it is no longer displayed by the device. Alternatively the value could be a length of time (eg 2 hours) to display the message. In another embodiment the message could be given a message ID or expiration ID. This may be applicable in the case of devices with no absolute time reference (that is lacking a clock) or are otherwise limited in their ability to measure a time period. The building automation system, or the information centre could record the time period that each message was valid for (based on the message ID or expiration ID), and at the end of this period send a message to the device instructing it to cease displaying the message (again using the message ID).

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Common building automation or management systems typically convey information between devices using data packets, and such packets often have upper limits on their length. The messages for use in a common building automation or management system should be as short as possible to usefully perform some function, but allow extension to allow greater amounts of information to be conveyed where appropriate. In one embodiment the majority of messages are sufficiently short such that they each fit into a single packet. However if the information to be conveyed is too large for a single packet, then multiple packets may be used to convey the required amount of information.

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In one embodiment a message might be limited to 10, 12, 20 or some other small number of octets in length. Such a message may contain the following information:

- a command octet identifying the message command, and optionally the protocol version identification;

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- a sequence octet containing a field identifying the total number of packets used to make up an entire command, and a field identifying which packet from the total set this packet is, these fields allowing longer commands to be made from a series of smaller packets if desired;

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- a services and options octet containing fields indicating if the number portion is present or absent and if the symbol identification portion is present or absent, and a field defining the type of information being conveyed, this field allowing different devices to selectively display different pieces of information depending on the desire and setup of a user;
- some optional number octets with the purpose and meaning described herein;

some optional symbol octets with the purpose and meaning described herein;

and a series of octets containing the text portion, this portion encoding the textual information, in a few characters, with the purpose and meaning described herein.

5 In a building management system which limits packets to approximately 12 to 20 octets in length, such a message may allow the transport of a basic weather forecast in a single packet. Such a forecast might only contain a single symbol (cloudy), a single number (20), and the word "CLOUDY". Depending on the precise number of octets used and method of coding, such a basic message might be typically from 12 to 20 octets in length.

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A more complex encoding which included the number of emails from a user's mailbox and which included the full text of the email address might require 20 or more characters just to convey the email address. Such a message might then require 25 to 50 octets to convey the information, again dependant on the exact coding used. If this length is too great for the building management or automation system to convey in a single packet then it would be broken into perhaps 2 or 3 packets. By including a packet sequence number and total packet count the re-assembly of the complete basic message becomes a trivial exercise for one skilled in the art.

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Many houses contain one or more simple control or status panels such as for alarm, air conditioning, and/or lighting systems. Such panels are typically always on, but are often resource limited, having small display areas as well as limited processing and memory capabilities. These features make them cost effective to use in device control systems and to distribute throughout the house in a building automation system. However such displays are typically unable to receive, process and/or display information from sources outside the building. Typically the inclusion of additional display, processing, memory capacity, and communications capability significantly increases the unit cost making them infeasible for deployment in all but the most expensive and sophisticated building automation systems.

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The above embodiments outline an advantageous system for displaying a message in a building automation system. An information centre can be utilised to receive information from one or more sources. One or more servers in the information centre receive this information, and parse the information to extract one or more portions of information, and the servers may then format these portions of information into one or more messages having several predefined fields such as message type, symbol, number and description fields. A database of subscribers can then be interrogated to obtain a list of subscribers who wish to receive the message. For each subscriber in this list the message may be sent to the associated delivery address over the internet. A gateway device at the

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delivery address receives the message and provides it to a building automation system. The building automation system may include one or more display capable devices. A display capable device can receive the message, break the message into the various message fields, and then displays this information based on the available display area of the device. This thus provides a way for a simple
5 device to display useful basic information to a building occupant who can use this information to make further decision. Alternatively the devices could represent the information in audio formats, or act in response to received messages, such as to turn on an air conditioner, or record a program.

The information centre (or centres) can accept information from the various internet services, format
10 that information, and send it as required to the subscribing homes or buildings with gateway devices. The information centre need only make a small charge to each subscriber, and by accumulating many such customers, can make possible the payment of the substantial fees for high quality data services. Typically this will be more cost effective for subscribers than the individual subscribers subscribing directly with the commercial information providers.

15 The use of a central information centre also has advantages in the event that the data services providers change the method or format of distribution, as only a single point needs to be updated. In the case of multiple such centres, the code only needs to be updated once and can easily be distributed to the various centres. The system can also take advantage of the wealth of free information available
20 on the internet. The development and adaptation of software to collect and process this information is a specialised task that is beyond the skill of most home owners, but can be cost effectively performed by a centralised site.

The system utilises a convenient, low-cost gateway device that may be simply installed and forgotten,
25 to connect the building automation system and the information centre. The gateway device only needs enough setup information to know about the building automation system, and how to access the information centre. The gateway device has several functions, which include preventing unauthorised access to the services of a building, allowing control of the services in the building from a remote location, and for acquiring information from the information centre. Other optional functions of the
30 gateway device are also possible. Depending upon the capabilities of the gateway device, the gateway device could receive metadata from an information centre on sources of information and how to process or parse the received information. This enables the development of a distributed system in which the individual gateways perform the bulk of the processing, with the information centre providing the instructions on how to perform the processing.

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The above system takes advantage of the infrastructure and capabilities of existing building automation systems and devices and subsystems forming such systems. In particular the definition of message protocol, and the development of software based on these protocols allows ready integration into small, low cost graphical display and control devices such as those used for lighting control or similar controls in building automation system.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgement of any form of suggestion that such prior art forms part of the common general knowledge.

It will be understood that the term “comprise” and any of its derivatives (eg. comprises, comprising) as used in this specification is to be taken to be inclusive of features to which it refers, and is not meant to exclude the presence of any additional features unless otherwise stated or implied.

Although an illustrative embodiment of the present invention has been described in the foregoing detailed description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the scope of the invention as set forth and defined by the following claims.

THE CLAIMS

1. A system for preparing and displaying information in at least a portion of a display area of a display capable device, the system comprising:

an information centre, comprising:

5 a subscriber database wherein the subscriber database comprises a plurality of subscribers and each subscriber has an associated message delivery address;

one or more servers, wherein the one or more servers receive information from one or more sources, extract one or more portions of the received information and send the one or more portions to one or more message delivery addresses in the subscriber database;

10 a gateway device located at the message delivery address for receiving the one or more portions of information sent from the information centre and providing in one or more messages to one or more of the display capable devices associated with the gateway device; and

one or more display capable devices, each display capable device comprising

15 a communications interface for receiving the one or more messages provided by the gateway device; and

a display area wherein at least a portion of the display area is used to display a representation of the one or more portions of information in the received one or more messages.

20 2. A system as claimed in claim 1, wherein the one or more servers format the extracted portion of the received information into one or more messages each having a predefined format, the predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol, number and description fields, and each display capable device further comprising a processor for parsing the received message according to the predetermined format.

30 3. A system as claimed in claim 2, wherein the information centre further comprises an information database, and the servers store the extracted one or more portions of the received information in the information database, and associate a source and an expiration time with each portion, and the one or more messages are generated from the one or more portions of information retrieved from the information database.

35 4. A system as claimed in claim 1, wherein the gateway device formats the received one or more portions of information from the one or more servers into the one or more messages each having a

predefined format, the predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol, number and description fields, and each display capable device further comprises a processor for parsing the received message according to the predetermined format.

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5. A system as claimed in any one of claims 1 to 4 wherein the one or more sources comprise at least one internet site, and extracting one or more portions of the received information comprises receiving web content from the at least one internet site and computationally parsing the web content to extract one or more portions of information comprised in the received web content.

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6. A system as claimed in any one of claims 1 to 5, wherein if an attempt to extract a portion of information from a first source fails, then an attempt is made to extract equivalent information from a second source.

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7. A system as claimed in any one of claims 1 to 4 further comprising a user interface to allow subscribers to configure one or more characteristics of messages provided to the one or more display capable devices associated with the subscriber.

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8. A system as claimed in claim 7 wherein the gateway device is part of a building automation system which comprises one or more display capable devices.

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9. A system as claimed in claim 7 or 8, wherein the gateway device further comprises a user interface to allow a user to specify which display capable devices messages are provided to by the gateway device.

10. A system as claimed in any one of claims 2 to 9, wherein the data portion comprises at least the symbol field, and wherein the representation of the symbol field is based upon the values stored in the message type field and the symbol field.

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11. A system as claimed in any one of claims 2 to 10, wherein the header portion further comprises a protocol version field for indicating format of the data portion.

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12. A system as claimed in claim 11, wherein the one or more display capable devices first extract the protocol version field from the received message and use the extracted protocol version to determine how to parse the data portion of the received message.

13. A system as claimed in any one of claims 1 to 12, wherein each of the one or more display capable devices also determine the size of the available portion of the display area and use this information to determine which of the received one or more portions of information to represent in the display area.

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14. A system as claimed in any one of claims 1 to 12, wherein the representation in a display capable device of the one or more portions of information in the received one or more messages is displayed as a plurality of sequential representations, each of the plurality of sequential representations of a size less than the size of the available portion of the display area.

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15. An information centre for use in a system for displaying information in at least a portion of a display area of a display capable device, comprising:

a subscriber database wherein the database comprises a plurality of subscribers, each subscriber having an associated message delivery address;

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one or more servers, wherein the one or more servers receive information from one or more sources, extract one or more portions of the received information, format into one or more messages, and send the one or more messages to one or more message delivery addresses in the subscriber database.

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16. An information centre as claimed in claim 15, further comprising an information database, wherein the servers store the extracted one or more portions of the received information in the information database, and associate a source and an expiration time with each portion, and the one or more messages are generated from the one or more portions of information retrieved from the information database.

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17. An information centre as claimed in claim 15 or 16 wherein the one or more sources comprise at least one internet site, and extracting one or more portions of the received information comprises receiving web content from the at least one internet site and computationally parsing the web content to extract one or more portions of information comprised in the received web content.

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18. An information centre as claimed in any one of claims 15 to 17, wherein if an attempt to extract a portion of information from a first source fails, then an attempt is made to extract equivalent information from a second source.

19. An information centre as claimed in any one of claims 15 to 18 further comprising a user interface to allow subscribers to configure characteristics of the one or more messages sent to the delivery address associated with the subscriber.

5 20. An information centre as claimed in any one of claims 15 to 19 wherein the one or more messages are formatted according to a predefined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol, number and description field.

10 21. A gateway device for use in a building automation system comprising one or more display capable devices, the gateway device comprising a communications interface and a processor, wherein the communications interface receives one or more portions of information for displaying in a portion of a display area of display capable devices in the building automation system, and the
15 communications interface sends the one or more portions of information to one or more display capable devices in one or more messages in a predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol, number and description fields, and the gateway device provides the message in the predetermined format to the one or more display capable devices.

20 22. A gateway device as claimed in claim 21, wherein the received one or more portions of information are received in the predetermined format.

23. A gateway device as claimed in claim 22 wherein the header portion of the predefined format further comprises a protocol version field for indicating the format of the data portion, and each
25 display capable device has an associated maximum protocol version that the device is capable of displaying, and if the processor determines that the protocol version of the received one or more portions of information is higher than the maximum protocol version that a display capable device in the building automation system is capable of displaying, then the gateway device reformats the received one or more portions of information according to a protocol version suitable for display by
30 the display capable device.

24. A gateway device as claimed in claim 21, wherein the processor formats the received information into one or more messages in the predetermined format.

35 25. A gateway device as claimed in claim 24, wherein the header portion of each message further comprises a protocol version field, and the processor formats the one or more messages according to a

plurality of predefined protocol versions based upon the capabilities of the display capable devices in the building automation system.

26. A gateway device for use in a building automation system comprising one or more display capable devices, the gateway device comprising a communications interface and a processor, wherein the communications interface requests information from one or more external sources and the processor parses the received information to extract and format one or more portions of information into one or more messages in a predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from a group of symbol, number and description fields, and the communications interface sends the one or more messages to the one or more display capable devices for displaying the one or more portions of information in at least a portion of the display area of the display capable device.

27. A gateway device as claimed in claim 26, wherein the external sources comprise at least one internet site and the gateway device receives instructions for parsing the information obtained from the at least one internet site from an information server.

28. A gateway device as claimed in any one of claims 26 to 28, wherein the gateway device comprises a user interface to allow a user to configure which message types are provided to each of the display capable devices.

29. A gateway device as claimed in any one of claims 26 to 28, wherein the gateway device comprises a user interface to allow users to configure one or more characteristics of messages sent to display capable devices.

30. A gateway device as claimed in claim 29, wherein the user interface communicates with a subscriber database in an information centre for configuring information sent to the gateway device by the information centre.

31. A method for generating a message for displaying information in a portion of a display area of a display capable device, the method comprising:

receiving information from one or more sources;

extracting one or more portions of the received information and formatting the extracted one or more portions into a message, the message comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and description fields.

32. A method as claimed in claim 30, wherein the header portion further comprises a protocol version field and the format of the data portion is in accordance with a predefined message protocol associated with the value in the protocol version field.

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33. A method as claimed in claim 30 or 32, wherein the data portion comprises an expiration field.

34. A method as claimed in any one of claims 30 to 33 further comprising:

extracting one or more addresses from a subscriber database and sending the message to each
10 of the one or more addresses.

35. A method as claimed in claim 34 wherein at least one of the one or more addresses is an IP address of a gateway device associated with a subscriber in the subscriber database, wherein the gateway device sends the message to one or more display capable devices associated with the gateway
15 device.

36. A method as claimed in any one of claims 30 to 35, wherein the number field is less than 9 octets wide and the description field is less than 200 octets wide.

20 37. A method as claimed in any one of claims 30 to 36 wherein the one or more sources comprise one or more internet sites.

38. A method as claimed in any one of claims 30 to 37 wherein the message comprises information extracted from information received from a plurality of sources.

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39. A method as claimed in any one of claims 30 to 38 wherein the extracting one or more portions is performed by computationally parsing the received information.

40. A method for displaying information received in a message in a portion of a display area of a
30 display capable device, the method comprising:

receiving a message;

parsing the received message according to a predetermined format, wherein the predetermined format comprises a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and
35 description fields; and

displaying a representation of the information in the data portion in a portion of display area of a display capable device.

41. A method as claimed in claim 40, wherein the display capable device further comprises a plurality of symbol representations, each symbol representation having at least one associated symbol value, and if the data portion of the received message comprises at least the symbol field, then the representation of the symbol field is selected based on the symbol representation associated with the symbol field value.

42. A method as claimed in claim 41, wherein each symbol representation also has at least one associated message type value, and the display capable device selects the representation of the symbol based upon the value of the message type field and the value of the symbol field.

43. A method as claimed in any one of claims 40 to 42, further comprising the step of determining the size of the available portion of the display area and choosing which fields of the data portion to represent in the display area based upon the size.

44. A method as claimed in any one of claims 40 to 43, wherein if the size of the available portion of the display area is insufficient to display all of the information in the data portion, then splitting the information in the data portion into two or more representations for sequential representation in the display area where each of the two or more representations is of a size that may be displayed in the available portion of the display area.

45. A method as claimed in any one of claims 40 to 44, wherein the header portion further comprises a protocol version field and the value of the protocol version field is used to parse the data portion of the message.

46. A method as claimed in any one of claims 40 to 45, wherein if the available portion of the display area changes, the representation of the information in the data portion changes in response to the new size of the available portion of the display area.

47. A method as claimed in any one of claims 40 to 46, wherein the data portion further comprises an expiration field and the step of displaying a representation of the information is only performed if the message has not expired.

48. A display capable device in a building automation system for displaying a received message in a portion of a display area, the device comprising:

a storage device;

a communications interface for receiving a message;

5 a processor for parsing the received message, the processor operatively coupled to the storage device and the communications interface; and

a display area wherein at least a portion of the display area is used to display a representation of the information in the received message.

10 49. A display capable device as claimed in claim 48 wherein the received message is in a predetermined format comprising a header portion and a data portion, the header portion comprising at least a message type field, and the data portion comprising at least two fields from the group of symbol, number and description fields, and the representation is based upon the data portion.

15 50. A display capable device as claimed in claim 48, the storage device further comprising a plurality of symbol representations, each symbol representation having at least one associated symbol value, and wherein when the data portion comprises at least the symbol field, and the representation of the symbol field is selected by the processor based on the symbol representation associated with the received symbol field value.

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51. A display capable device as claimed in claim 50, wherein each symbol representation also has at least one associated message type value, and the processor selects the representation of the symbol based upon the value of the message type field and the value of the symbol field.

25 52. A display capable device as claimed in any one of claim 48 to 51, wherein the processor determines which fields of the data portion to represent in the display area based upon the size of the available portion of the display area.

30 53. A display capable device as claimed in any one of claim 48 to 52, wherein if the processor determines that the size of the available portion of the display area is insufficient to display all of the information in the data portion then the processor splits the information in the data portion into two or more representations for sequential representation in the display area where each of the two or more representations is of a size that may be displayed in the available portion of the display area.

35 54. A display capable device as claimed in any one of claim 48 to 53, wherein the communications interface receives at least one additional message, and the processor parses the

message, and alternately displays representations of the message and the at least one additional message.

55. A display capable device as claimed in any one of claim 48 to 54, wherein the header portion
5 further comprises a protocol version field and the processor uses the extracted protocol version to determine how to parse the data portion of the received message.

56. A display capable device as claimed in any one of claim 48 to 55, wherein if the available
10 portion of the display area changes, the representation of the information in the data portion changes in response to the size of the newly available portion of the display area.

57. A display capable device as claimed in any one of claim 48 to 56, wherein the message further
comprises an expiration time and the processor only displays the message if it has not expired.

58. A system for providing information to one or more devices in a building automation system,
15 the system comprising:
an information centre, comprising:
a subscriber database wherein the subscriber database comprises a plurality of
subscribers and each subscriber has an associated message delivery address;
one or more servers, the one or more servers receiving information from one
20 or more sources, extracting one or more portions of the received information and
sending the one or more portions to one or more message delivery addresses in the
subscriber database;
a building automation system comprising a plurality of devices, wherein the message delivery
address corresponds to a device in the building automation system, and one or more devices act upon
25 the received one or more portions of information.

59. A system as claimed in claim 58, wherein acting upon the received one or more portions of
information comprises forwarding the received one or more portions of information to one or more
other devices in the building automation system.

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60. A system as claimed in claim 58 or 59, wherein acting upon the received one or more portions
of information comprises visually representing the received one or more portions of information in at
least a portion of a display area of the device.

61. A system as claimed in claim 58 or 59, wherein acting upon the received one or more portions of information comprises generating a sound representing the received one or more portions of information.

5 62. A system as claimed in claim 58 or 59, wherein acting upon the received one or more portions of information comprises performing a control function based upon the received one or more portions of information.

10 63. A system as claimed in claim 58 or 59, wherein acting upon the received one or more portions of information comprises one or more of visually representing the received one or more portions of information in at least a portion of a display area of the device, generating a sound representing the received one or more portions of information or performing a control function based upon the received one or more portions of information.

15 64. A gateway device for use in a building automation system comprising a plurality of devices, the gateway device comprising a communications interface and a processor, wherein the communications interface receives one or more portions of information and provides the one or more portions of information to at least one of the plurality of devices, and the one or more devices act upon the received one or more portions of information.

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65. A device in a building automation system, the device comprising:
a communications interface for receiving a message comprising one or more portions of information obtained from one or more sources external to the building automation system;
a processor for parsing the received message and acting upon the received one or more
25 portions of information.

66. A system for preparing and displaying a message in at least a portion of a display area of a display capable device, the system comprising:

an information centre, comprising:

30 a subscriber database wherein the subscriber database comprises a plurality of subscribers and each subscriber has an associated message delivery address;
one or more servers, wherein the one or more servers receive information from one or more sources, and determine one or more sets of instructions for extracting one or more portions of information from the received information and send one or more sets of instructions to the one or more message delivery addresses in
35 the subscriber database;

a gateway device located at the message delivery address comprising a communications interface and a processor, wherein the communications interface receives the one or more sets of instructions and receives information from one or more sources, and the processor extract one or more portions of information from the information received from the one or more sources using the received
5 one or more sets of instructions, and the communications interface sends the one or more portions of information in one or more messages to one or more display capable devices associated with the gateway device; and

one or more display capable devices, each display capable device comprising

a communications interface for receiving a message provided by the gateway device;

10 and

a display area wherein at least a portion of the display area is used to display a representation of the one or more portions of information in the received one or more messages.

15 67. A gateway device in a building automation system, comprising a communications interface and a processor, wherein the communications interface receives from an information server one or more sets of instructions for the processor for extracting one or more portions of information from one or more sources of information, and the processor executes the one or more sets of instructions to obtain one or more portions of information from information received from an external source, and the
20 gateway device sends the one or more portions of information to one or more devices in the building automation system and the one or more devices act upon the received one or more portions of information.