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FILING RECEIPT



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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 61/255,678**

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Early Publication Request: No

**** SMALL ENTITY ****

Title

Proximity Based Home Energy Management System And Method

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Exhibit 1015
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Ex. 1015.0001

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Provisional Application for Patent Cover Sheet					
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Inventor(s)					
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Given Name	Middle Name	Family Name	City	State	Country ;
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Title of Invention		Proximity Based Home Energy Management System And Method			
Attorney Docket Number (if applicable)		39285-00010			
Correspondence Address					
Direct all correspondence to (select one):					
☒ The address corresponding to Customer Number			☐ Firm or Individual Name		
Customer Number			59582		

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.	
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Applicant claims small entity status under 37 CFR 1.27

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Signature	/John S. Artz/			Date (YYYY-MM-DD)	2009-10-28
First Name	John S.	Last Name	Artz	Registration Number (If appropriate)	36431

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1 System Overview

1.1 Purpose

The purpose of Allure Energy's Proximity Application Prototype (hereafter "Prototype") is two-fold:

- To serve as a demonstration of a proximity-based home energy management approach.
- To collect historical data that will be used to assess the potential energy cost savings of a proximity-based energy management approach.
- To collect historical data that can be used to identify and evaluate more sophisticated energy management approaches.

1.2 Functionality

The Prototype provides the following functionality to its users:

- Decreases the user's energy cost by detecting when the user is away from home and adjusting the user's thermostat setpoint to reduce energy use.
- Maintains the user's comfort by detecting that they are returning home and returning the user's thermostat to its original setpoint.
- Allows the user to do the following from their mobile phone:
 - Monitor the thermostat's setpoint and the indoor temperature
 - Change the thermostat setpoint
 - Enable or disable automatic setpoint control
- Notifies the user by mobile phone text message when:
 - The thermostat setpoint has been changed manually
 - The indoor temperature exceeds user-defined limits
 - Potential energy savings are being lost because the prototype is in manual mode

The Prototype also provides functionality to Allure Energy's administrators and analysts, including:

- Monitor the real-time status of the overall system and of each customer site
- Extract and analyze historical data collected during system operation including a history of user location, thermostat settings, automatic control actions, and the inside and outside temperature.

1.3 Structure

The Prototype consists of the following three software components:

- Blackberry Client software – Uses GPS to track the location of the user so that home energy use can be decreased when the user is away from home. This software also provides the user with a way to set the thermostat's setpoint and to monitor the current

setpoint and temperature. This software runs on the user's GPS-enabled Blackberry mobile phone.

- Server software – Receives user location updates from the Blackberry Client and calculates the user's distance and/or time from home. Using that calculation, the Server determines when the user's thermostat setpoint should be changed and makes those changes. The Server software also periodically receives a data report from each site containing thermostat control and status information and stores that historical data for later retrieval by the Blackberry Client and for offline historical analysis. In addition, the Server software notifies the user, through the Blackberry Client, if the setpoint is changed manually by someone in the home, or if the inside temperature exceeds user-defined limits.
- Home Controller software - The Home Controller software periodically retrieves the latest thermostat control and status information and sends it to the Server. It is also responsible for making thermostat setpoint changes on behalf of the Server. The Home Controller accesses the home thermostat via Zigbee wireless network.

These three software components, and their relationships to each other, are illustrated in the Component Model diagram attached as Exhibit A.

As mentioned above, the Blackberry Client software will run on the user's Blackberry mobile phone. The Server software will run on a Linux server platform, along with the MySQL database server that manages the Server software's persistent database. The Home Controller will run on a Linux-based Marvell SheevaPlug plug computer. This deployment of the prototype's software components onto hardware platforms is illustrated in the Deployment Model diagram attached as Exhibit B.

1.4 Overview of Pilot

The Prototype is an early "pilot" implementation of Allure Energy's future Energy Management System.

- Sophistication – The energy savings approaches that will be implemented in the future Energy Management System will be more sophisticated and will include a self learning and self adapting system. The system will be upgradeable to include the following:
 - Adaptive / Self Learning Thermostat and software that adapts to a users thermostat setting preferences when at home or away
 - Automatically updating user location zones using variables such as time-to-home, distance-to-home, current traffic and weather conditions, or various other inputs that can allow for dynamic creation of location zones
 - Purchasing energy based on real time market pricing, relative to current and future customer needs (using customer profile information)
 - Expanding control over other smart appliances as they are introduced to a home
 - Establishing a residential smart grid for reporting energy consumption, creating real-time monitoring systems, and sending consumption data

and profiles between third parties such as utilities or other service providers

- Multiple user / multiple thermostat operating environment
 - Energy efficiency characterization of residence to determine operating condition of heater, air conditioner, appliances, etc.
 - Create promotional channel to allow for promoting energy savings items that can be used by a residence in response to an energy efficiency characterization and/or a users consumption habits
- Distribution of Functionality – The prototype system’s energy management functionality will be hosted in the Server, and the Home Controller will be used to provide access to the wireless home automation network. In the future, the energy management functionality will distributed across both the Server and the Home Controller.
 - Scale – The Prototype is designed to operate on a small scale. The future Energy Management System may operate on the scale of millions of customers.
 - Mobile Devices – The Prototype will support certain models of GPS-enabled Blackberry mobile phone. The future Energy Management System will support a wider variety of mobile devices.
 - Security – The Energy Management System will fully protect the user’s privacy and data.

If possible, Allure Energy would like to reuse elements of the Prototype design and implementation when creating its future Energy Management System. The limitations listed above should be considered temporary by the designers and implementers of the Prototype. They should design and implement the Prototype in ways that maximize design and implementation reuse and that will eventually allow the preceding limitations to be removed.

2 Functional Requirements

2.1 Energy Savings Approach

The Server component of the Prototype is responsible for controlling the temperature at the site in order to save energy. This document section describes the energy savings approach implemented by the Server.

2.1.1 Automatic / Manual mode

At each site (residence) the system will be running in either Automatic mode or Manual mode, as determined by the user. In Automatic mode, the Server will monitor the user's proximity to the site and, if the user is away, automatically modify the site's thermostat to save energy cost. In Manual mode, the Server will not automatically modify the thermostat setpoint, but instead will maintain the thermostat at the user-specified "base" setpoint. In either mode, the user will be able to remotely change the thermostat setpoint and monitor the current thermostat setpoint and temperature. And in either mode the Server will collect historical data.

Using the Blackberry Client, the user will be able to switch their site between Automatic and Manual mode. If the user leaves the system in Manual mode, they will be reminded, by notification text message, that the system is still in Manual mode and that they could be saving energy, if the system were in Automatic mode. This notification will occur no more than once per day when the user leaves home and the potential energy savings are being lost.

2.1.2 Heating / Cooling mode

When running in Automatic mode, a site can also be in Heating or Cooling mode. In Heating mode, the Server lowers the thermostat setpoint, when appropriate, to save energy. In Cooling mode, the Server raises the thermostat setpoint, when appropriate, to save energy. Heating / Cooling mode is not relevant when the site is in Manual mode because the Server will not automatically change (raise or lower) the thermostat setpoint when in Manual mode.

2.1.3 Temperature Control Variables

The following variables are used by the Prototype's energy management control logic:

- **ThermostatSetpoint** – The setpoint that is being maintained at the site's thermostat.
- **BaseSetpoint** – The nominal setpoint specified by the user. When in Manual mode this is the setpoint value that the Server will apply to the thermostat. When in Automatic mode the Server will, when appropriate, calculate a deviation from the BaseSetpoint value, the SetpointDelta, which will be added to the BaseSetpoint and applied to the thermostat to realize energy savings.
- **SetpointDelta** – Calculated by the Server and added to, or subtracted from, the BaseSetpoint value to determine an energy-saving ThermostatSetpoint. In Automatic/Cooling mode, the SetpointDelta will be added to the BaseSetpoint to determine the ThermostatSetpoint. In Automatic/Heating mode, the SetpointDelta

will be subtracted from the BaseSetpoint to determine the ThermostatSetpoint. When in Manual mode, SetpointDelta will always be zero.

- HeatingMinAutoSetpoint – The minimum setpoint that the Server may apply to the thermostat when in Heating mode. Specified by the user. This limit only applies when the site is in Automatic mode. When in Manual mode, the user may change the setpoint to any value that the thermostat can accommodate.
- CoolingMaxAutoSetpoint – The maximum setpoint that the Server may apply to the thermostat when in Cooling mode. Specified by the user. This limit only applies when the site is in Automatic mode. When in Manual mode, the user may change the setpoint to any value that the thermostat can accommodate.

2.1.4 Changing the BaseSetpoint

The BaseSetpoint value may be under control of the user. The user sets or changes the BaseSetpoint in one of two ways:

- Through the BlackBerryClient user interface on the user's mobile phone
- By manually changing the thermostat's setpoint

2.1.5 Changing the Heating / Cooling mode

Whether the site is in Heating mode or Cooling mode is also under control of the user. The user indicates the desired mode by changing the heating/cooling mode at the thermostat.

2.1.6 Proximity Zones

When in Automatic mode, the Server will calculate the SetpointDelta based on the user's proximity to the home. Periodically, the BlackBerry Client reports the current user location (latitude, longitude) to the Server. The Server will then calculate the distance (great-circle distance) from the user's site (residence) to the current user location. This distance will be used to determine which proximity zone the user is in. Initially, the Prototype will support four proximity zones, as shown in Figure 1, below.

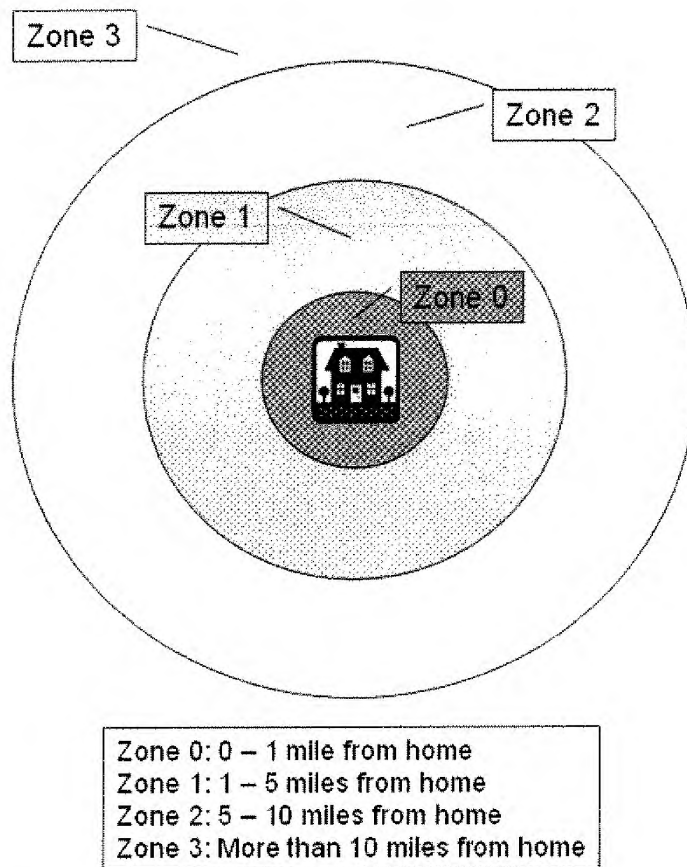


Figure 1: Proximity Zones

Note: The radii of the proximity zones will be configurable in the Prototype. The radii shown in Figure 1 are typical values.

2.1.7 Calculating SetpointDelta and ThermostatSetpoint

A new SetpointDelta and ThermostatSetpoint will be calculated under each of the following conditions:

- User switches site from Automatic mode to Manual mode or from Manual mode to Automatic mode
- Site is in Automatic mode and the Server receives a user location update from a Blackberry Client
- Server detects that a manual BaseSetpoint change has been made at the thermostat
- Server detects that the Heating / Cooling mode has been changed at the thermostat

Whenever a new ThermostatSetpoint is calculated it is compared to the most recent setpoint data collected from the site's thermostat, and if the newly calculated

ThermostatSetpoint is different, it is sent to the Home Controller and applied to the site's thermostat.

The equations for calculating SetpointDelta and ThermostatDelta are different for Manual mode and Automatic mode, as described below.

2.1.7.1 Manual mode

In Manual mode, the SetpointDelta and ThermostatSetpoint are determined by the following equations:

- $\text{SetpointDelta} = 0$
- $\text{ThermostatSetpoint} = \text{BaseSetpoint}$

2.1.7.2 Automatic mode

A PercentMaxDelta value is associated with each of the proximity zones described above in Section 2.1.6. Table 1, below, shows typical PercentMaxDelta values for each zone.

Zone	PercentMaxDelta	Description
0	0%	There is no delta from the BaseSetpoint when the user is in this zone (close to the residence)
1	50%	50% of the maximum setpoint delta range (MaxSetpointDelta) is applied when the user is in this zone.
2	75%	75% of the maximum setpoint delta range (MaxSetpointDelta) is applied when the user is in this zone.
3	100%	All of the maximum setpoint delta range (MaxSetpointDelta) is applied when the user is in this zone.

Table 1: PercentMaxDelta values by Zone

Note: The PercentMaxDelta values for the proximity zones will be configurable in the Prototype. The values shown in Table 1 are typical values.

When in Automatic mode, the PercentMaxDelta value is used in the calculation of the SetpointDelta and ThermostatSetpoint, as shown in Table 2 below.

Control Mode	Equations
Automatic / Cooling	$\text{MaxSetpointDelta} = \text{CoolingMaxAutoSetpoint} - \text{BaseSetpoint}$ $\text{SetpointDelta} = \text{MaxSetpointDelta} * \text{PercentMaxDelta}$ $\text{ThermostatSetpoint} = \text{BaseSetpoint} + \text{SetpointDelta}$
Automatic / Heating	$\text{MaxSetpointDelta} = \text{BaseSetpoint} - \text{HeatingMinAutoSetpoint}$ $\text{SetpointDelta} = \text{MaxSetpointDelta} * \text{PercentMaxDelta}$ $\text{ThermostatSetpoint} = \text{BaseSetpoint} - \text{SetpointDelta}$

Table 2: SetpointDelta & ThermostatSetpoint equations

If there are multiple users at a site, then the proximity zone of the user closest to the site is the “effective” proximity zone used for the automatic-mode calculations described above. This is shown in Table 3, below.

User 1 Zone	User 2 Zone	Effective Zone
0	0	0
2	0	0
1	3	1
3	3	3

Table 3: Determining Effective Proximity Zone

2.1.8 Blackberry periodically updates its current location

At a time interval determined by the Server, the Blackberry Client periodically acquires its current location from its GPS. This location is sent to the Server which will calculate the user's distance from home. If in automatic mode, the Server will then calculate whether a thermostat setpoint change is needed, and if so, will change the thermostat's setpoint, via the Home Controller. The sequence diagram attached as Exhibit C illustrates the component interactions that support this use case.

2.1.9 Home Controller periodically reports online status to Server

At a time interval configured by an Administrator (site report interval), the Home Controller will send a report to the Server indicating that it is online. If the Server has a pending control action (thermostat setpoint change) for the site, then that control action is passed to the Home Controller as part of the report response. The Home Controller will execute the control action (change the thermostat setpoint) and send a message to the Server confirming that the control action has been executed as shown in Exhibit D.

2.1.10 Home Controller periodically sends thermostat data to Server

At a time interval configured by an Administrator (data report interval), the Home Controller will query the thermostat for its latest control and temperature data. This data will include whether the thermostat is in heating or cooling mode, whether the HVAC device is currently on or off, the current thermostat setpoint, and the current indoor temperature. The Home Control reports this data to the Server. The Server combines this information with the current control parameters and the outdoor temperature at the site and creates a new historical data record containing this thermostat data.

Note: The Server determines the outdoor temperature by retrieving it from an online weather service. For example, the current weather conditions (in XML format) for zipcode 78704 can be retrieved from
<http://api.wunderground.com/auto/wui/geo/WXCurrentObXML/index.xml?query=78704>.

If the Server has a pending control action for the site (thermostat setpoint change), then that control action is passed to the Home Controller as part of the report response. The Home Controller will execute the control action (change the thermostat setpoint) and send a message to the Server confirming that the control action has been executed.

Note: When the Home Controller sends a thermostat data report to the Server it is also indicating that it is online, as described in Section 2.1.9. The same message is used for both purposes. For example, if the site report interval is 1 minute and the data report interval is 3 minutes, then every 1 minute the Home Controller will send a site report to the Server and every third site report contains thermostat data.

2.1.11 User views latest site data using Blackberry

At the user's request, the Blackberry Client will query the Server for the latest temperature and temperature control data for the user's site. This includes whether the thermostat is in heating or cooling mode, whether the HVAC device is on or off, the user-specified base setpoint, whether the thermostat is being automatically controlled or not, the current setpoint delta, the current thermostat setpoint, the temperature inside the site, the temperature outside the site, the current energy savings rate, and the age of this data. The Blackberry Client displays this information to the user. The sequence diagram, attached as Exhibit E illustrates the component interactions that support this use case.

2.1.12 User changes base setpoint using Blackberry

At the user's request, the Blackberry Client will send a message to the Server to change the thermostat's base setpoint. The Server will update the base setpoint value in the thermostat's database record. The Server will calculate a new thermostat setpoint and communicate the new thermostat setpoint to the site's thermostat. The sequence diagram attached as Exhibit F illustrates the component interactions that support this use case.

2.1.13 User enables or disables automatic control using Blackberry

At the user's request, the Blackberry Client will send a message to the Server enabling or disabling automatic setpoint control for the thermostat. The Server will update the manual/automatic mode value in the thermostat's database record. The Server will calculate a new thermostat setpoint and communicate the new thermostat setpoint to the site's thermostat. The sequence diagram attached as Exhibit G illustrates the component interactions that support this use case.

2.1.14 User changes base setpoint at site

A user manually changes the thermostat setpoint at the site. This is interpreted by the Prototype as a request to change the base setpoint. This setpoint change will be detected by the Server after its next periodic thermostat data query. The Server will update the base setpoint value in the database. If in automatic mode, the Server will also send a SMS text message to the user's Blackberry indicating that the setpoint on the thermostat has been manually changed by someone at the thermostat site. The text message will include the thermostat setpoint value before the manual change, and the thermostat setpoint value after the manual change. The sequence diagram attached as Exhibit H illustrates the component interactions that support this use case.

2.1.15 Server notifies user by Blackberry that a temperature limit has been exceeded

If in automatic mode, the Server will send a SMS text message to the user's Blackberry when the Server detects that the indoor temperature at the site is:

- Below the HeatingAutoMinSetpoint by 3 degrees or more while in heating mode
- Above the CoolingAutoMaxSetpoint by 3 degrees or more while in cooling mode

The text message will include the current indoor temperature and identify the limit that was exceeded. The sequence diagram attached as Exhibit I illustrates the component interactions that support this use case.

2.1.16 Server notifies user by Blackberry that system is still in manual mode

If in manual mode, the Server will send a SMS text message to the user's Blackberry when the Server detects that the user is traveling outbound and has left Zone0. The text message will remind the user that the system is currently in manual mode and that potential energy savings are being lost. This text message reminder will only be sent once a day. The sequence diagram attached as Exhibit J illustrates the component interactions that support this use case.

2.1.17 Administrator monitors system status

The Administrator uses a web browser to monitor the current operation of the system. The Administrator will be able to view overall system status through a web page with content similar to that shown below:

System Status

Number of Customers 3
Energy Savings Rate 7290 kW / h

Customer	Auto / Manual	Heating / Cooling	Base Setpoint (deg F)	Setpoint Delta (deg F)	Thermostat Setpoint (deg F)	Energy Savings (kW / h)
Jim Hollister	Auto	Cooling	77	4	81	2410
Kevin Imes	Auto	Cooling	78	8	86	4880
Alan Weber	Auto	Cooling	75	0	75	0

By selecting a customer, the Administrator will be able to “drill-down” to status details for that customer. The Customer Status information will be shown through a web page with content similar to that shown below:

Customer Status

Customer Jim Hollister
Address 2006 Chaparral Drive, Round Rock, TX 78681
Start Date 10/15/2009
Total Mobile Devices 2

Manual / Automatic Automatic
Cooling / Heating Cooling
Base Setpoint 77 F
Setpoint Delta 4 F
Thermostat Setpoint 81 F
Setpoint Limit 85 F
Inside Temperature 80 F
Outside Temperature 98 F
Savings Rate 2410 kw / hour

Thermostat Data Updated Now - 1 min 08 sec

Last Auto Control Action Now - 5 min 41 sec

Device	Zone	Distance from Site (miles)	Latitude (deg North)	Longitude (deg East)	Last Location Update
5129822552	1	3.1	30.481017	-97.678513	Now – 2 min 25 sec
5129221237	2	7.7	30.481008	-97.678899	Now – 6 min 58 sec

The Administrator will be able to refresh the information on each status screen (or that information will refresh itself).

Note: The Administrator provides the IP address of the Server where the status information is stored, as well as a valid username and password. This may be done through another web page or through a pop-up dialog.

2.1.18 Administrator retrieves and views historical data

The Administrator retrieves historical data from the Server Database historical tables for offline analysis. This is done with off-the-shelf database (RDB) access tools and data visualization tools. No special Server software is required to support this capability.

2.1.19 User installs and configures software on Blackberry

The user installs the Blackberry Client software on the Blackberry and configures it for operation. The user will supply:

- User's account ID
- User's site ID
- User's mobile device ID
- Server IP address

The Blackberry Client will query the Server for any other configuration data it requires. The sequence diagram attached as Exhibit K illustrates the component interactions that support this use case.

After installation and initial configuration, the Blackberry Client user interface should provide a way for the Server-based configuration data to be re-retrieved when requested by an Administrator, or by a User on behalf of an Administrator.

2.1.20 Administrator installs and configures software on Server

The Administrator installs the Server software on the Server and configures it for operation.

2.1.21 Administrator creates or modifies configuration data on Server

The Administrator creates new user configuration data (account, site, thermostat, mobile device) or modifies existing user configuration data. This data is stored in the configuration tables in the Server's database. For this Prototype, this is done manually by editing and executing database scripts.

2.1.22 Administrator installs and configures software on Home Controller

The Administrator installs the Home Controller software and configures it for operation. The Administrator will supply:

- User's account ID
- User's site ID
- Server IP address

The Home Controller will query the Server for any other configuration data it requires. The sequence diagram attached as Exhibit L illustrates the component interactions that support this use case.

After installation and initial configuration, the Home Controller should provide a way for the Server-based configuration data to be re-retrieved when requested by an Administrator.

2.1.23 Administrator views Server software log

The Administrator views a log of the internal operation of the Server software. This log will contain error, warning, information, and trace messages. The user will be able to determine which “level” of message is stored in the Server software log. The user will also be able to view the Server log from a computer at a remote location.

2.1.24 Administrator displays Blackberry Client stored variables

An Administrator, or a User at the behest of an Administrator, uses the Blackberry Client user interface to view key internal state variables of the Blackberry Client software. This is done to diagnose a system problem.

2.1.25 Blackberry notifies Server of warning or error condition

When the Blackberry Client software encounters a warning or error situation, it sends a warning/error notification to the Server to be logged. The sequence diagram attached as Exhibit M illustrates the component interactions that support this use case.

2.1.26 Home Controller notifies Server of warning or error condition

When the Home Controller software encounters a warning or error situation, it sends a warning/error notification to the Server to be logged. The sequence diagram attached as Exhibit N illustrates the component interactions that support this use case.

2.1.27 Administrator views Server diagnostic log

An Administrator views a software diagnostic log including past Server activity in order to diagnose a system problem. This log will also include warning/error messages sent by the Blackberry Client and Home Controller.

2.1.28 User views latest site data using Blackberry

At the user’s request, the Blackberry Client will query the Server for the latest temperature and temperature control data for the user’s site. This includes whether the thermostat is in heating or cooling mode, whether the HVAC device is on or off, the user-specified base setpoint, whether the thermostat is being automatically controlled or not, the current setpoint delta, the current thermostat setpoint, the temperature inside the site, the temperature outside the site, the current energy savings rate, and the age of this data. The Blackberry Client displays this information to the user. The sequence diagram attached as Exhibit O illustrates the component interactions that support this use case.

2.1.29 User changes base setpoint using Blackberry

At the user’s request, the Blackberry Client will send a message to the Server to change the thermostat’s base setpoint. The Server will update the base setpoint value in the thermostat’s database record. The Server will calculate a new thermostat setpoint and

communicate the new thermostat setpoint to the site's thermostat. The sequence diagram attached as Exhibit P illustrates the component interactions that support this use case.

2.1.30 User enables or disables automatic control using Blackberry

At the user's request, the Blackberry Client will send a message to the Server enabling or disabling automatic setpoint control for the thermostat. The Server will update the manual/automatic mode value in the thermostat's database record. The Server will calculate a new thermostat setpoint and communicate the new thermostat setpoint to the site's thermostat. The sequence diagram attached as Exhibit Q illustrates the component interactions that support this use case.

2.1.31 User changes base setpoint at site

A user manually changes the thermostat setpoint at the site. This is interpreted by the Prototype as a request to change the base setpoint. This setpoint change will be detected by the Server after its next periodic thermostat data query. The Server will update the base setpoint value in the database. If in automatic mode, the Server will also send a SMS text message to the user's Blackberry indicating that the setpoint on the thermostat has been manually changed by someone at the thermostat site. The text message will include the thermostat setpoint value before the manual change, and the thermostat setpoint value after the manual change. The sequence diagram attached as Exhibit R illustrates the component interactions that support this use case.

2.1.32 Server notifies user by Blackberry that a temperature limit has been exceeded

If in automatic mode, the Server will send a SMS text message to the user's Blackberry when the Server detects that the indoor temperature at the site is:

- Below the HeatingAutoMinSetpoint by 3 degrees or more while in heating mode
- Above the CoolingAutoMaxSetpoint by 3 degrees or more while in cooling mode

The text message will include the current indoor temperature and identify the limit that was exceeded. The sequence diagram attached as Exhibit S illustrates the component interactions that support this use case.

2.1.33 Server notifies user by Blackberry that system is still in manual mode

If in manual mode, the Server will send a SMS text message to the user's Blackberry when the Server detects that the user is traveling outbound and has left Zone0. The text message will remind the user that the system is currently in manual mode and that potential energy savings are being lost. This text message reminder will only be sent once

a day. The sequence diagram attached as Exhibit T illustrates the component interactions that support this use case.

2.1.34 Administrator monitors system status

The Administrator uses a web browser to monitor the current operation of the system. The Administrator will be able to view overall system status through a web page with content similar to that shown below:

System Status

Number of Customers 3

Energy Savings Rate 7290 kW / h

Customer	Auto / Manual	Heating / Cooling	Base Setpoint (deg F)	Setpoint Delta (deg F)	Thermostat Setpoint (deg F)	Energy Savings (kW / h)
<u>Jim Hollister</u>	Auto	Cooling	77	4	81	2410
<u>Kevin Imes</u>	Auto	Cooling	78	8	86	4880
<u>Alan Weber</u>	Auto	Cooling	75	0	75	0

By selecting a customer, the Administrator will be able to “drill-down” to status details for that customer. The Customer Status information will be shown through a web page with content similar to that shown below:

Customer Status

Customer Jim Hollister
Address 2006 Chaparral Drive, Round Rock, TX 78681
Start Date 10/15/2009
Total Mobile Devices 2

Manual / Automatic Automatic
Cooling / Heating Cooling
Base Setpoint 77 F
Setpoint Delta 4 F
Thermostat Setpoint 81 F
Setpoint Limit 85 F
Inside Temperature 80 F
Outside Temperature 98 F
Savings Rate 2410 kw / hour

Thermostat Data Updated Now - 1 min 08 sec
Last Auto Control Action Now - 5 min 41 sec

Device	Zone	Distance from Site (miles)	Latitude (deg North)	Longitude (deg East)	Last Location Update
5129822552	1	3.1	30.481017	-97.678513	Now – 2 min 25 sec
5129221237	2	7.7	30.481008	-97.678899	Now – 6 min 58 sec

The Administrator will be able to refresh the information on each status screen (or that information will refresh itself).

Note: The Administrator provides the IP address of the Server where the status information is stored, as well as a valid username and password. This may be done through another web page or through a pop-up dialog.

2.1.35 Administrator retrieves and views historical data

The Administrator retrieves historical data from the Server Database historical tables for offline analysis. This is done with off-the-shelf database (RDB) access tools and data visualization tools. No special Server software is required to support this capability.

2.1.36 User installs and configures software on Blackberry

The user installs the Blackberry Client software on the Blackberry and configures it for operation. The user will supply:

- User's account ID
- User's site ID
- User's mobile device ID
- Server IP address

The Blackberry Client will query the Server for any other configuration data it requires. The sequence diagram attached as Exhibit U illustrates the component interactions that support this use case.

After installation and initial configuration, the Blackberry Client user interface should provide a way for the Server-based configuration data to be re-retrieved when requested by an Administrator, or by a User on behalf of an Administrator.

2.1.37 Administrator installs and configures software on Server

The Administrator installs the Server software on the Server and configures it for operation.

2.1.38 Administrator creates or modifies configuration data on Server

The Administrator creates new user configuration data (account, site, thermostat, mobile device) or modifies existing user configuration data. This data is stored in the configuration tables in the Server's database. For this Prototype, this is done manually by editing and executing database scripts.

2.1.39 Administrator installs and configures software on Home Controller

The Administrator installs the Home Controller software and configures it for operation. The Administrator will supply:

- User's account ID
- User's site ID
- Server IP address

The Home Controller will query the Server for any other configuration data it requires. The sequence diagram attached as Exhibit V illustrates the component interactions that support this use case.

After installation and initial configuration, the Home Controller should provide a way for the Server-based configuration data to be re-retrieved when requested by an Administrator.

2.1.40 Administrator views Server software log

The Administrator views a log of the internal operation of the Server software. This log will contain error, warning, information, and trace messages. The user will be able to determine which “level” of message is stored in the Server software log. The user will also be able to view the Server log from a computer at a remote location.

2.1.41 Administrator displays Blackberry Client stored variables

An Administrator, or a User at the behest of an Administrator, uses the Blackberry Client user interface to view key internal state variables of the Blackberry Client software. This is done to diagnose a system problem.

2.1.42 Blackberry notifies Server of warning or error condition

When the Blackberry Client software encounters a warning or error situation, it sends a warning/error notification to the Server to be logged. The sequence diagram attached as Exhibit W illustrates the component interactions that support this use case.

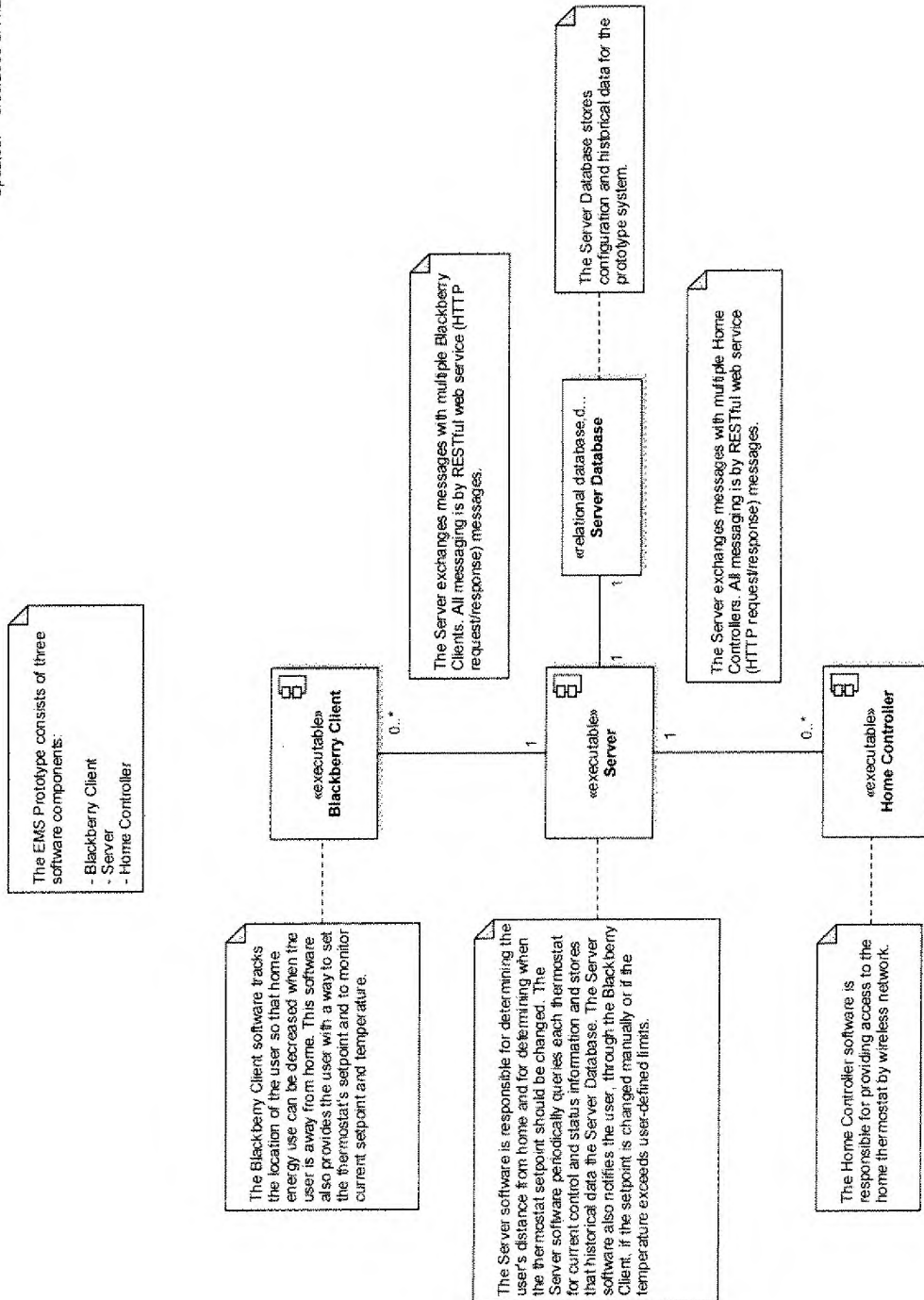
2.1.43 Home Controller notifies Server of warning or error condition

When the Home Controller software encounters a warning or error situation, it sends a warning/error notification to the Server to be logged. The sequence diagram attached as Exhibit X illustrates the component interactions that support this use case.

2.1.44 Administrator views Server diagnostic log

An Administrator views a software diagnostic log including past Server activity in order to diagnose a system problem. This log will also include warning/error messages sent by the Blackberry Client and Home Controller.

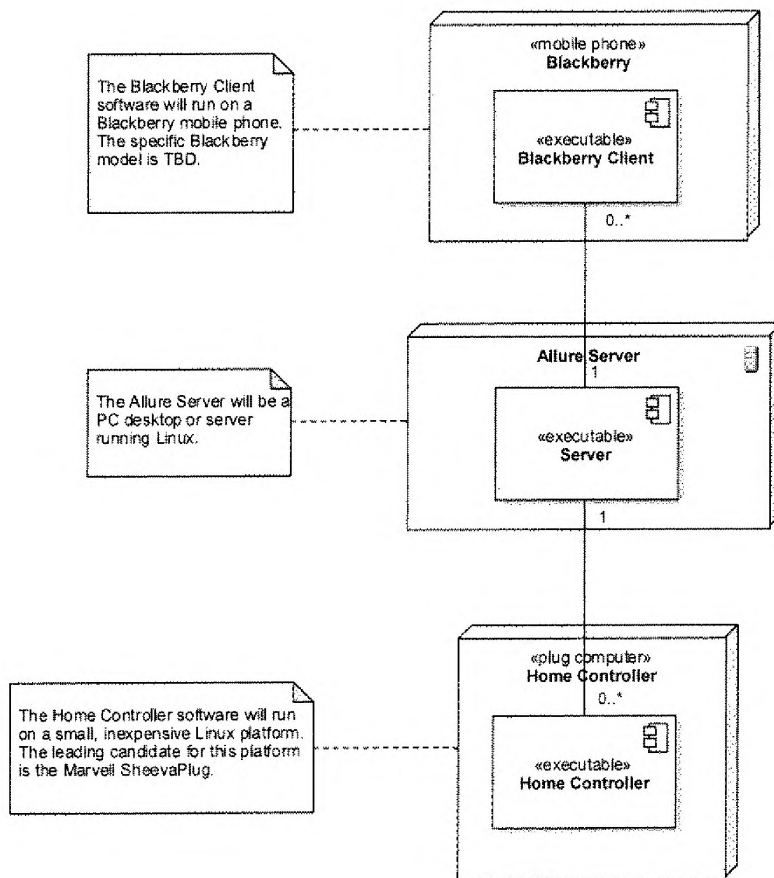
Name: Component Model
 Author: Jim Hollister
 Version: 1.0
 Created: 9/29/2009 2:07:12 PM
 Updated: 9/30/2009 6:41:29 PM

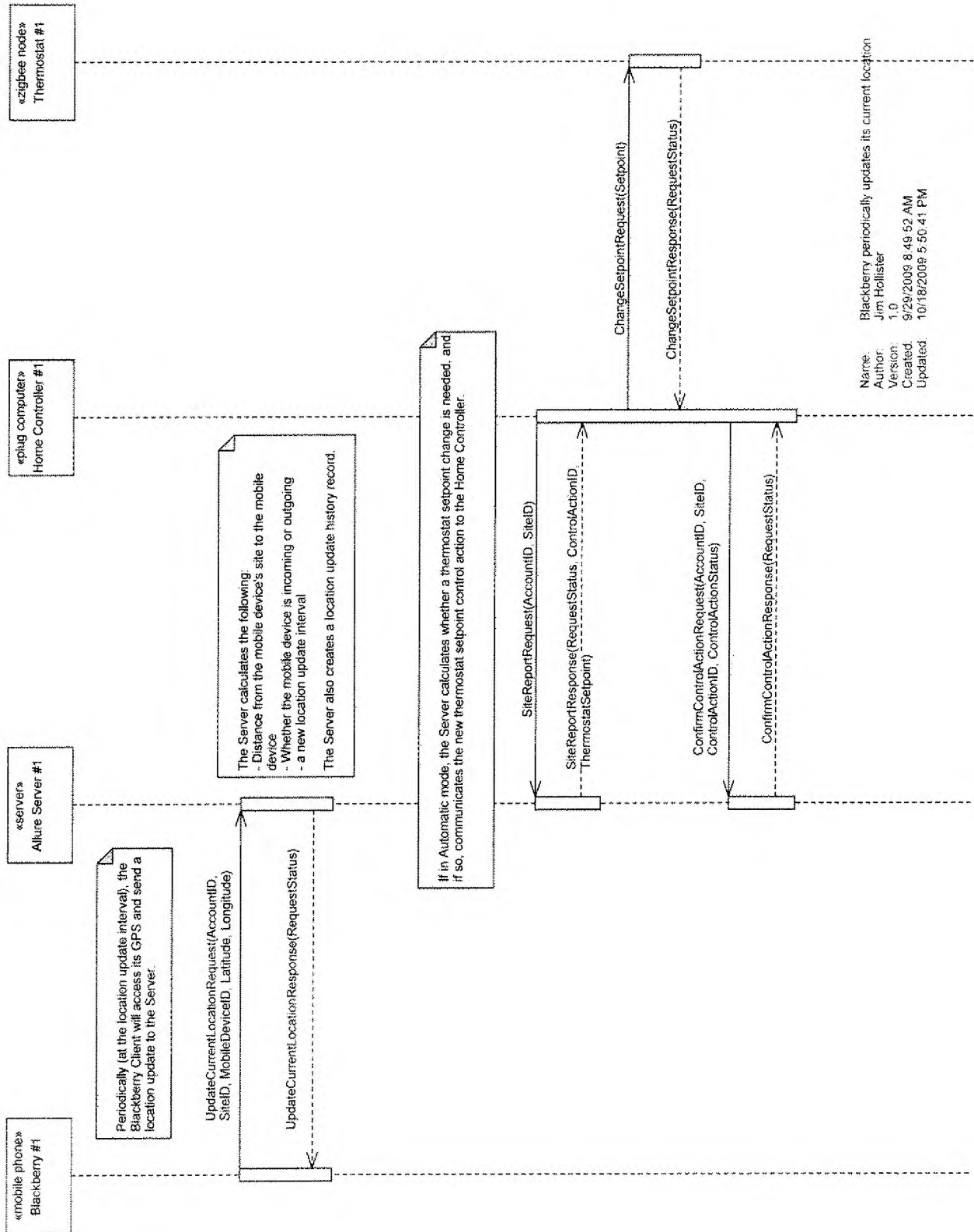


Ex.A

Name: Deployment Model
Author: Jim Hollister
Version: 1.0
Created: 9/29/2009 1:55:37 PM
Updated: 9/30/2009 6:44:52 PM

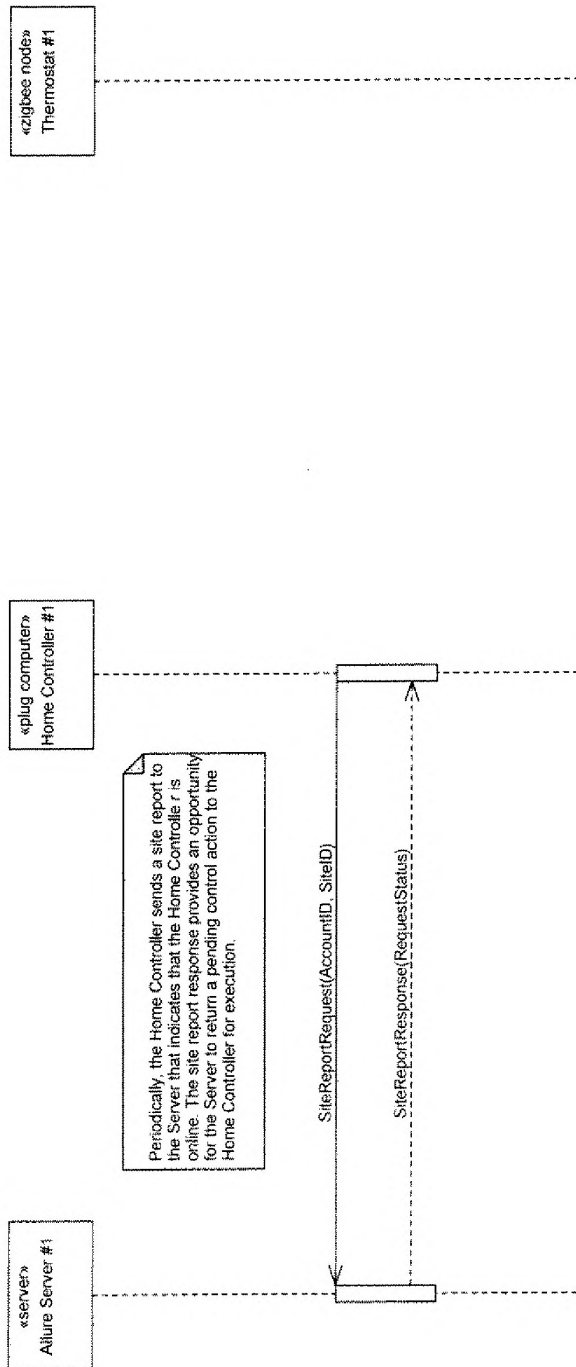
Ex. B





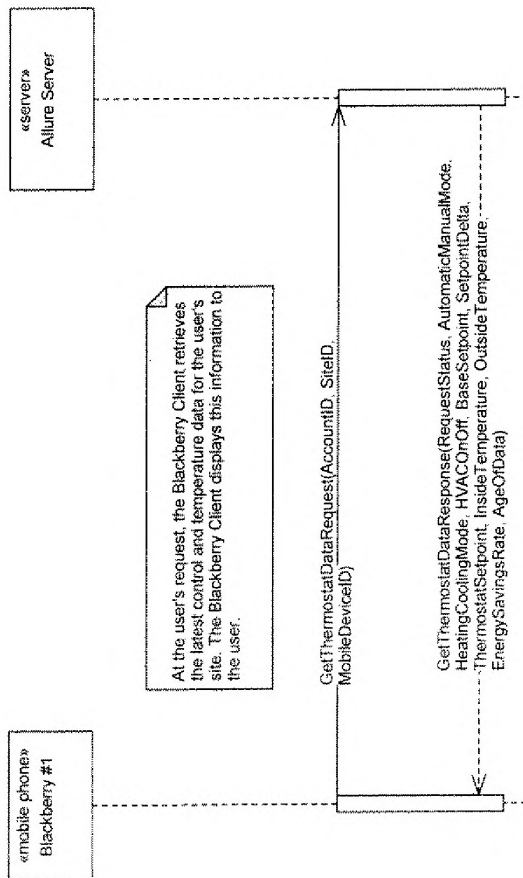
Name: Blackberry periodically updates its current location
 Author: Jim Hollister
 Version: 1.0
 Created: 9/29/2009 8:49:52 AM
 Updated: 10/18/2009 5:50:41 PM

Ex. C



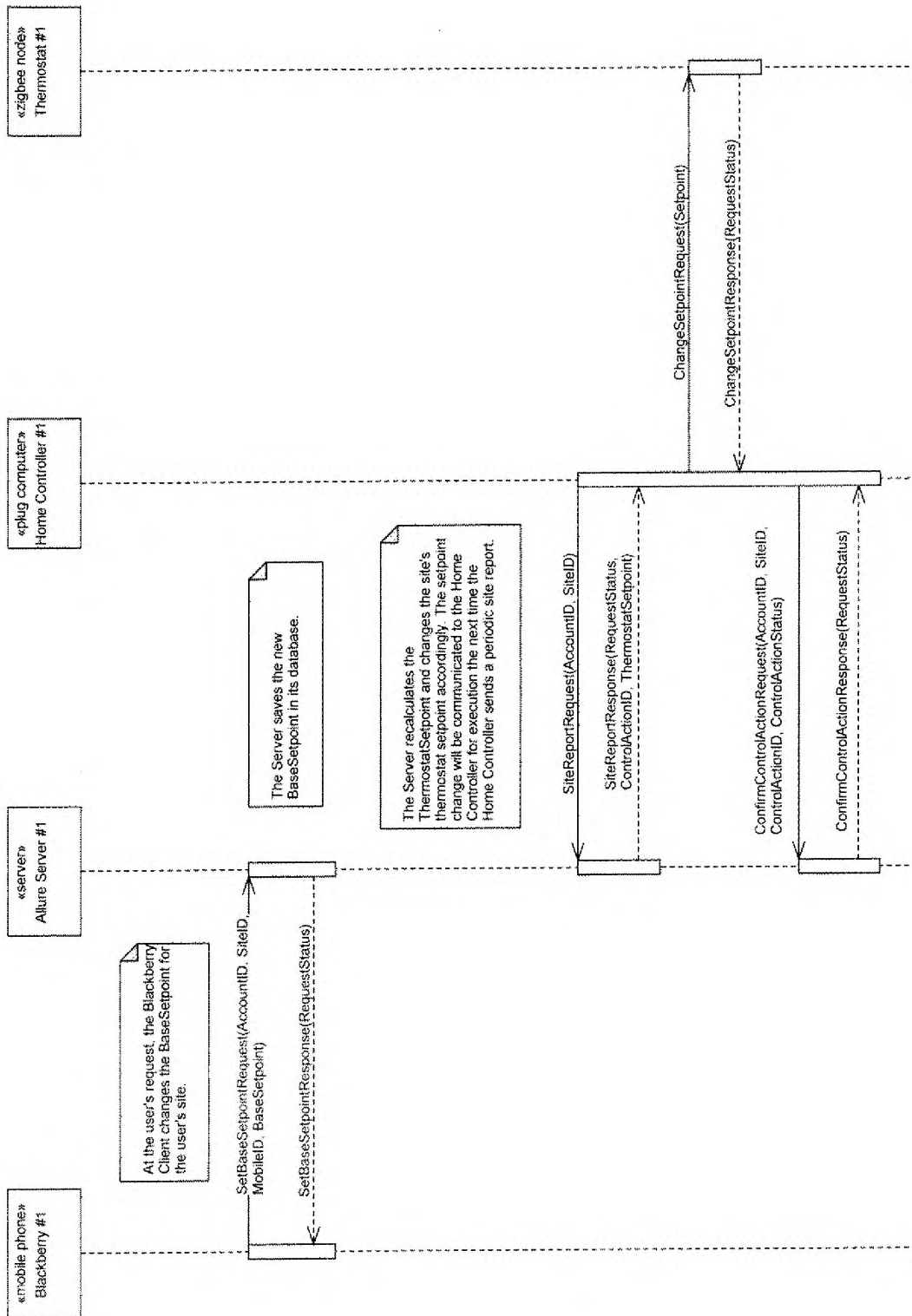
Name: Home Controller periodically reports online status to Server
 Author: Jimi Hollister
 Version: 1.0
 Created: 10/18/2009 5:40:31 PM
 Updated: 10/18/2009 5:48:28 PM

Ex. D



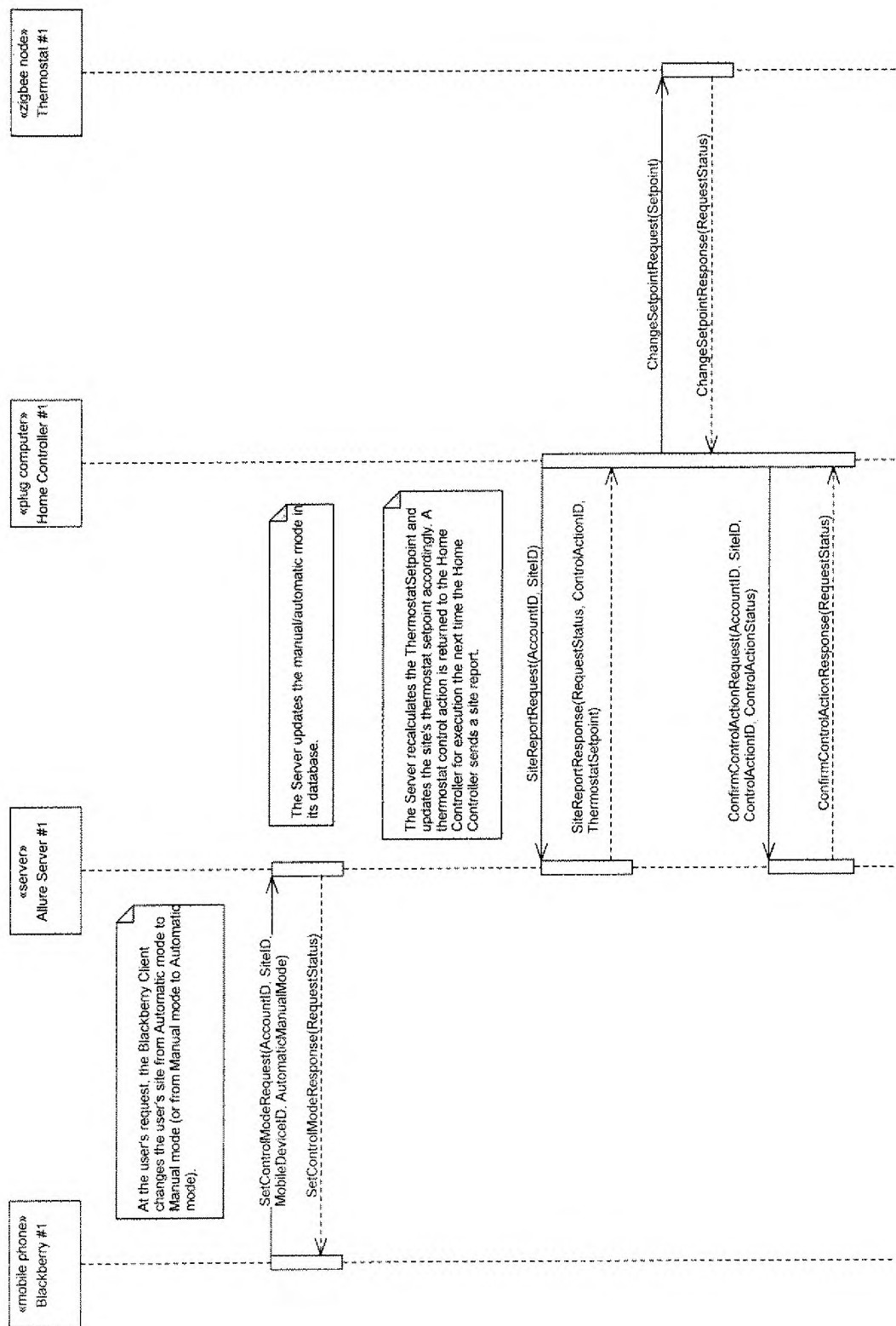
Name: User views latest site data using Blackberry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 1:11:54 PM
 Updated: 10/15/2009 5:07:10 PM

Ex. E



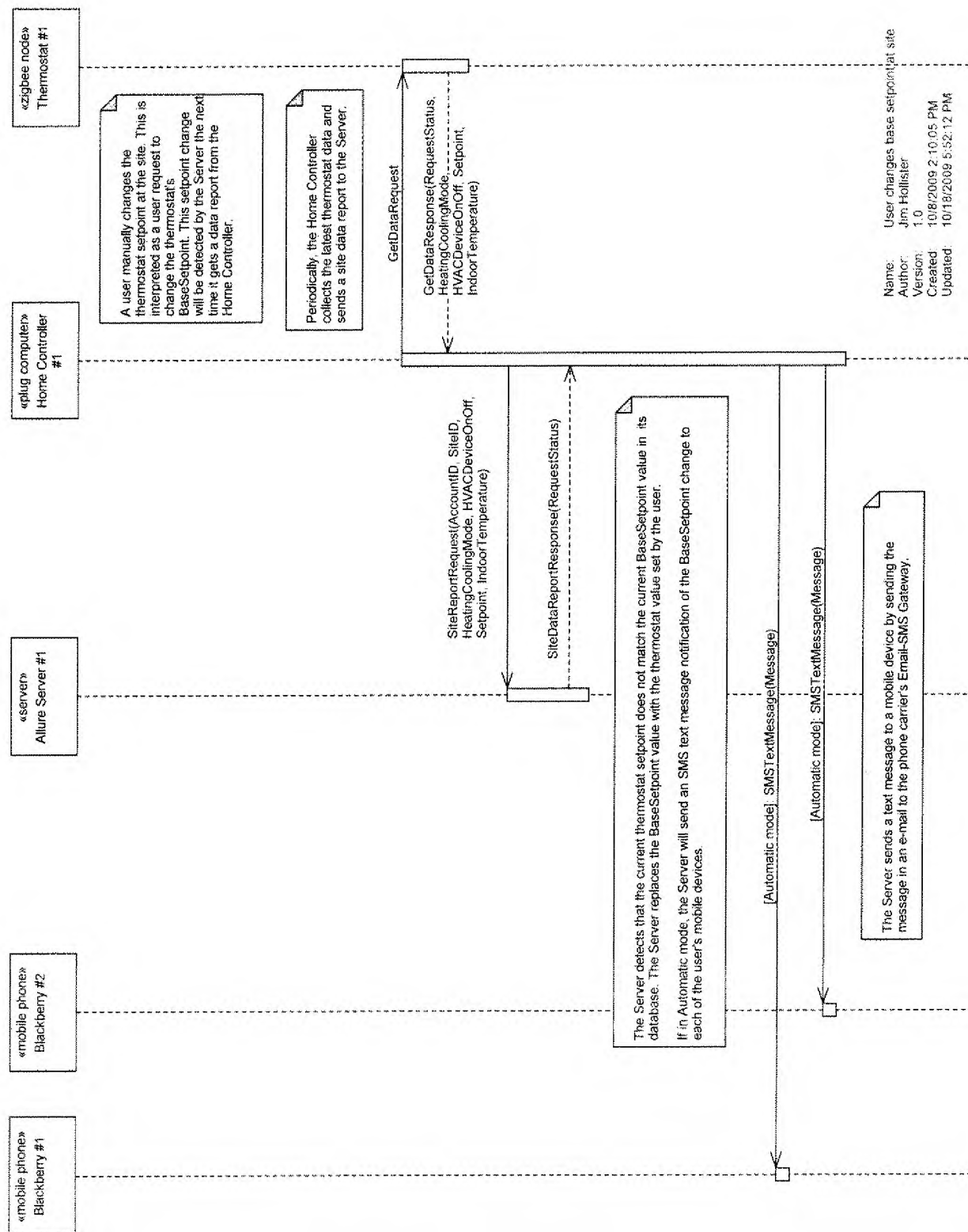
Name: User changes base setpoint using BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 1:23:19 PM
 Updated: 10/18/2009 5:53:45 PM

Ex. F

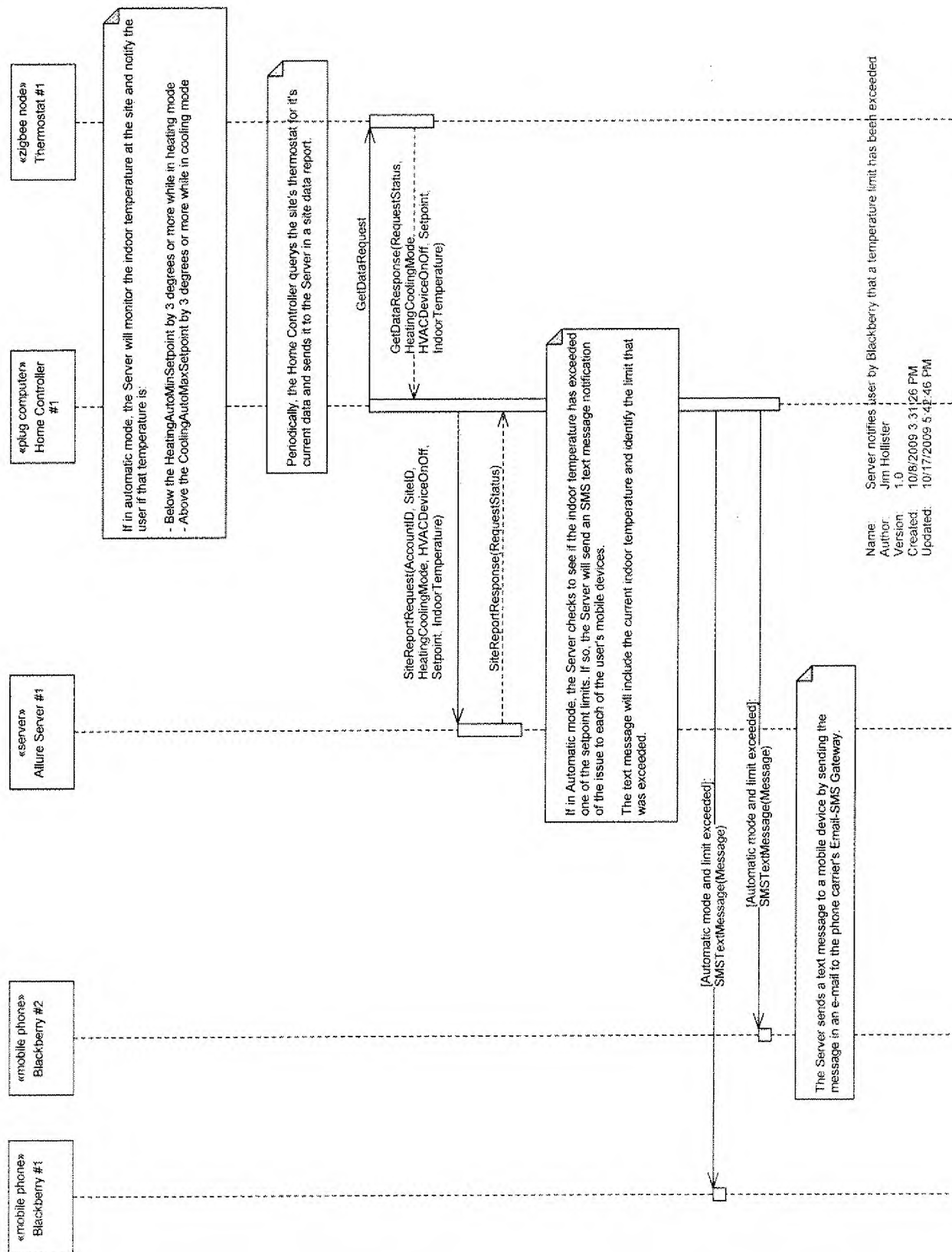


Name: User enables or disables automatic control using BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2003 1:44:00 PM
 Updated: 10/18/2009 5:55:13 PM

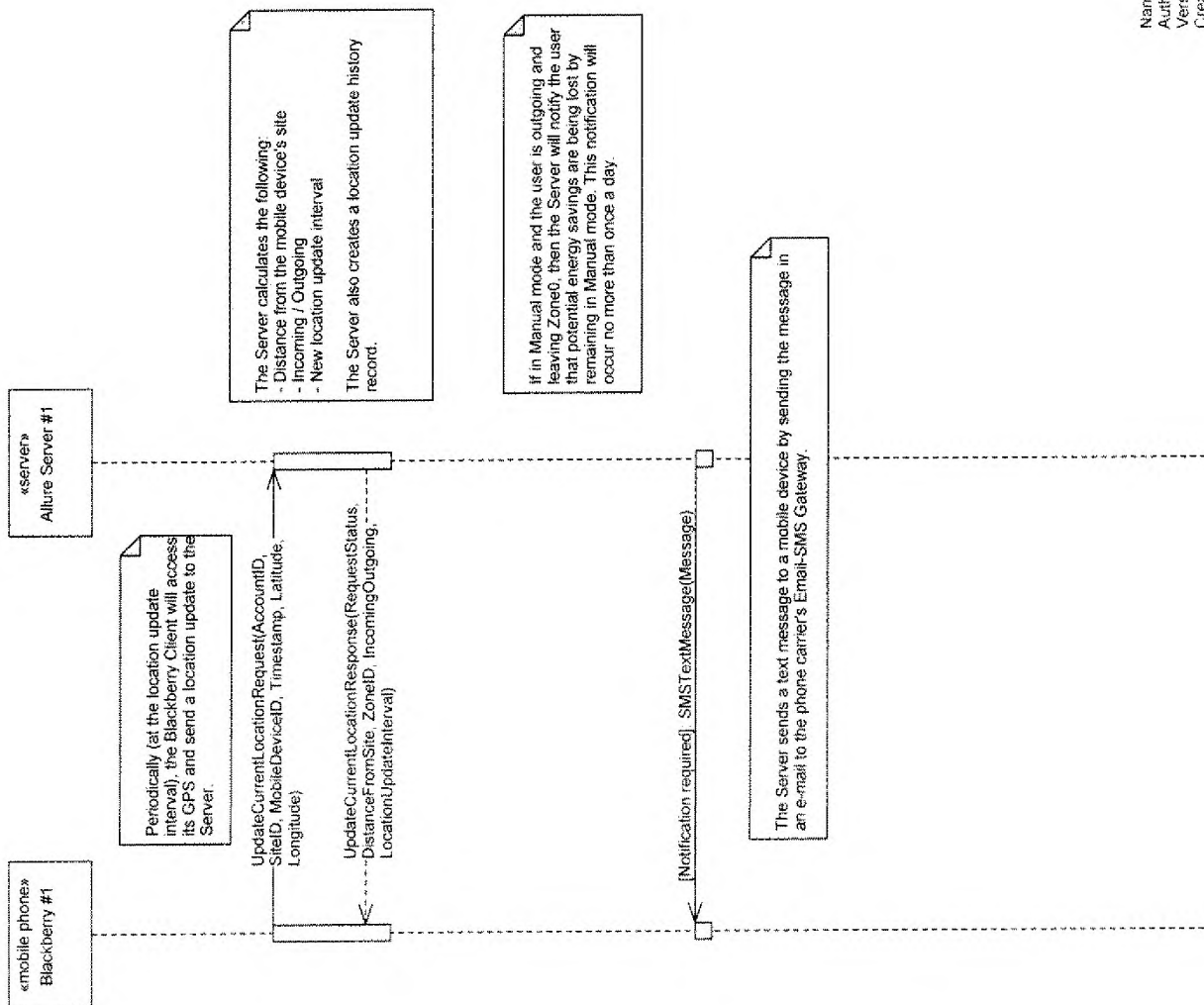
Ex. C



Ex. H

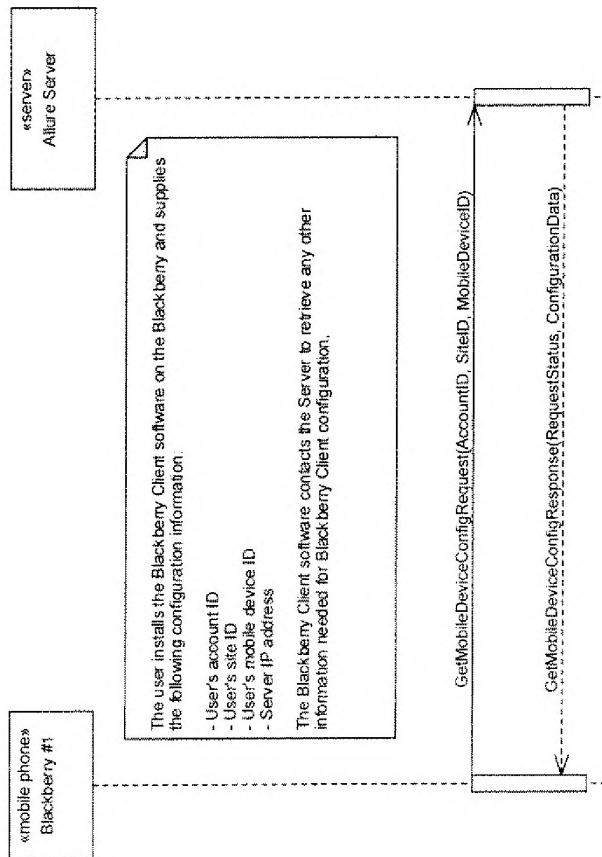


Ex. I



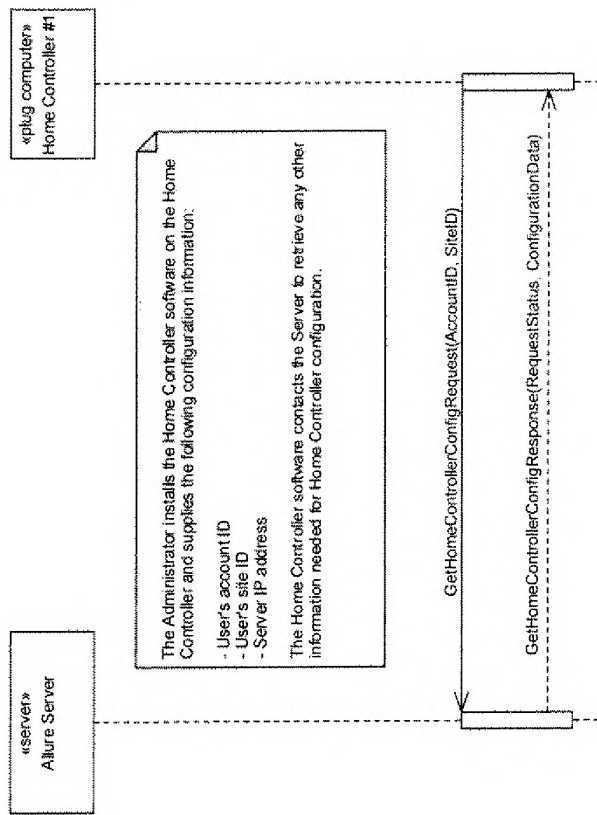
Name: Server notifies user by Blackberry that system is still in manual mode
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 3:38:49 PM
 Updated: 10/17/2009 5:43:28 PM

Ex. J



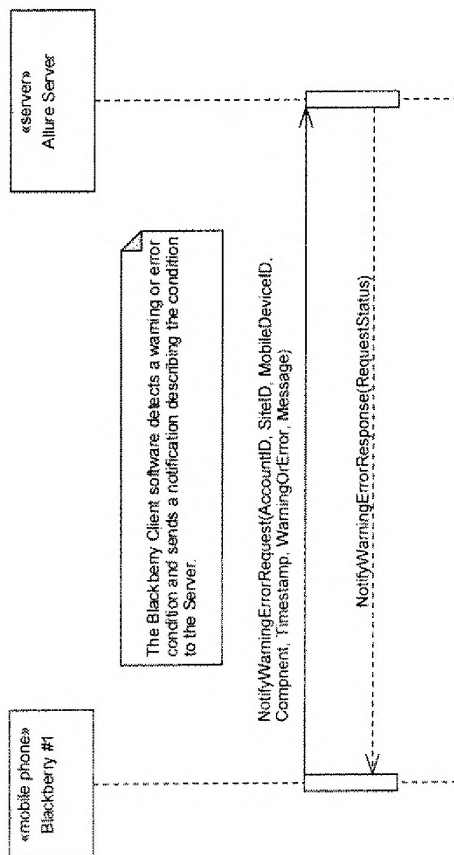
Name: User installs and configures software on BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 11:18:18 AM
 Updated: 10/8/2009 11:30:57 AM

Ex. K



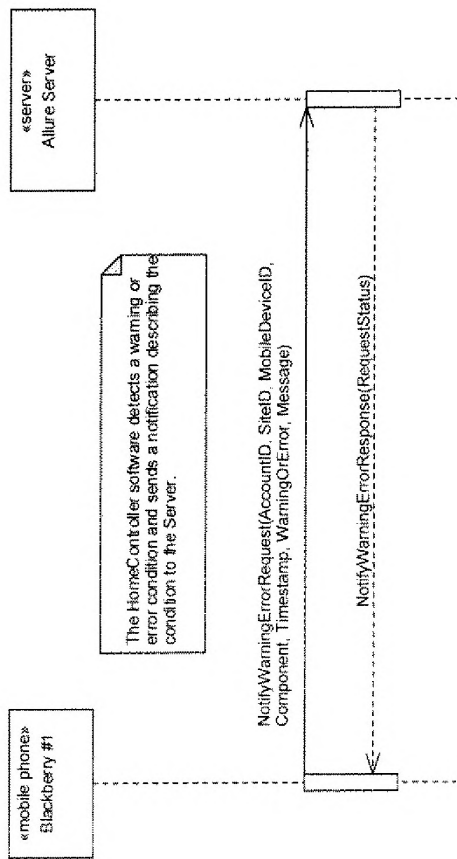
Name: Administrator installs and configures software on Home Controller
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 11:24:58 AM
 Updated: 10/9/2009 11:31:33 AM

Ex. L



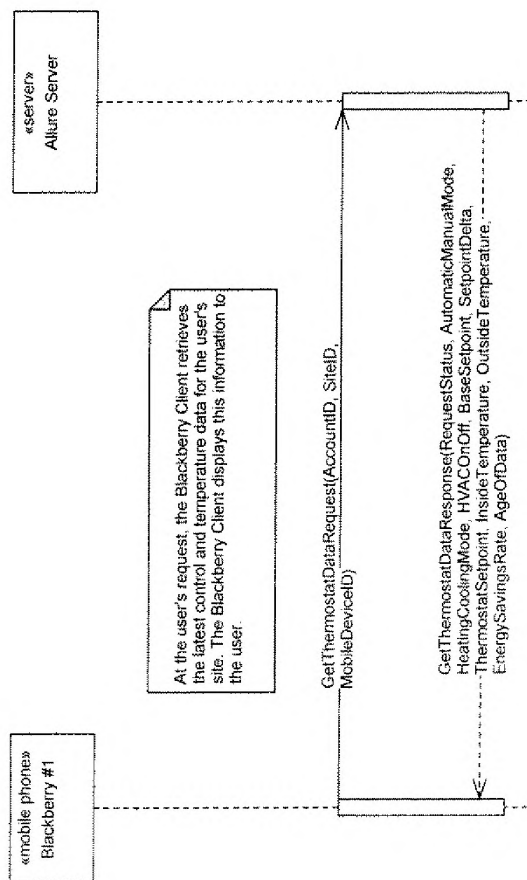
Name: Blackberry notifies Server of warning or error condition
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 4:47:41 PM
 Updated: 10/9/2009 5:03:26 PM

Ex. M



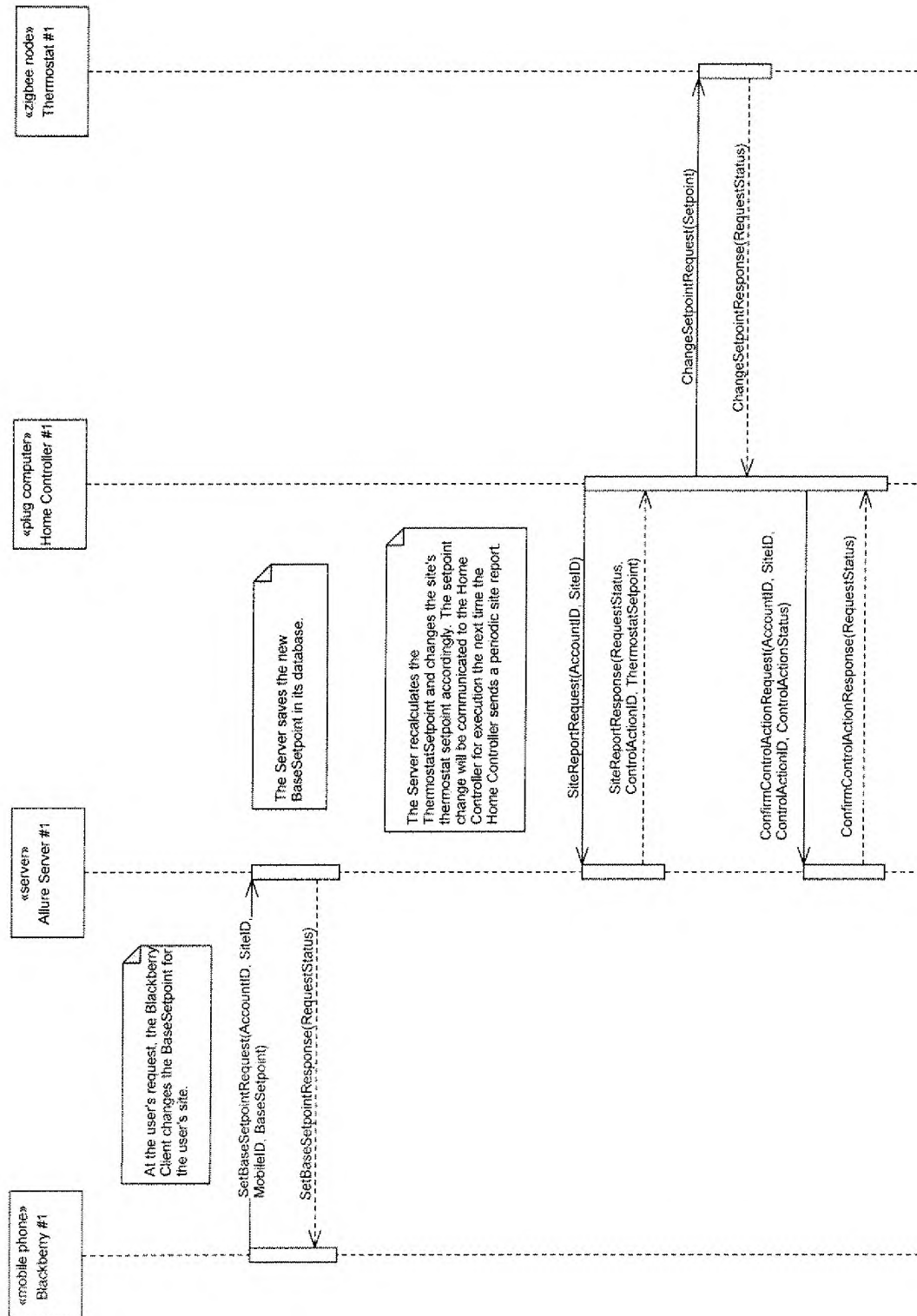
Name: Home Controller notifies Server of warning or error condition
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 5:02:14 PM
 Updated: 10/9/2009 5:03:34 PM

Ex. N



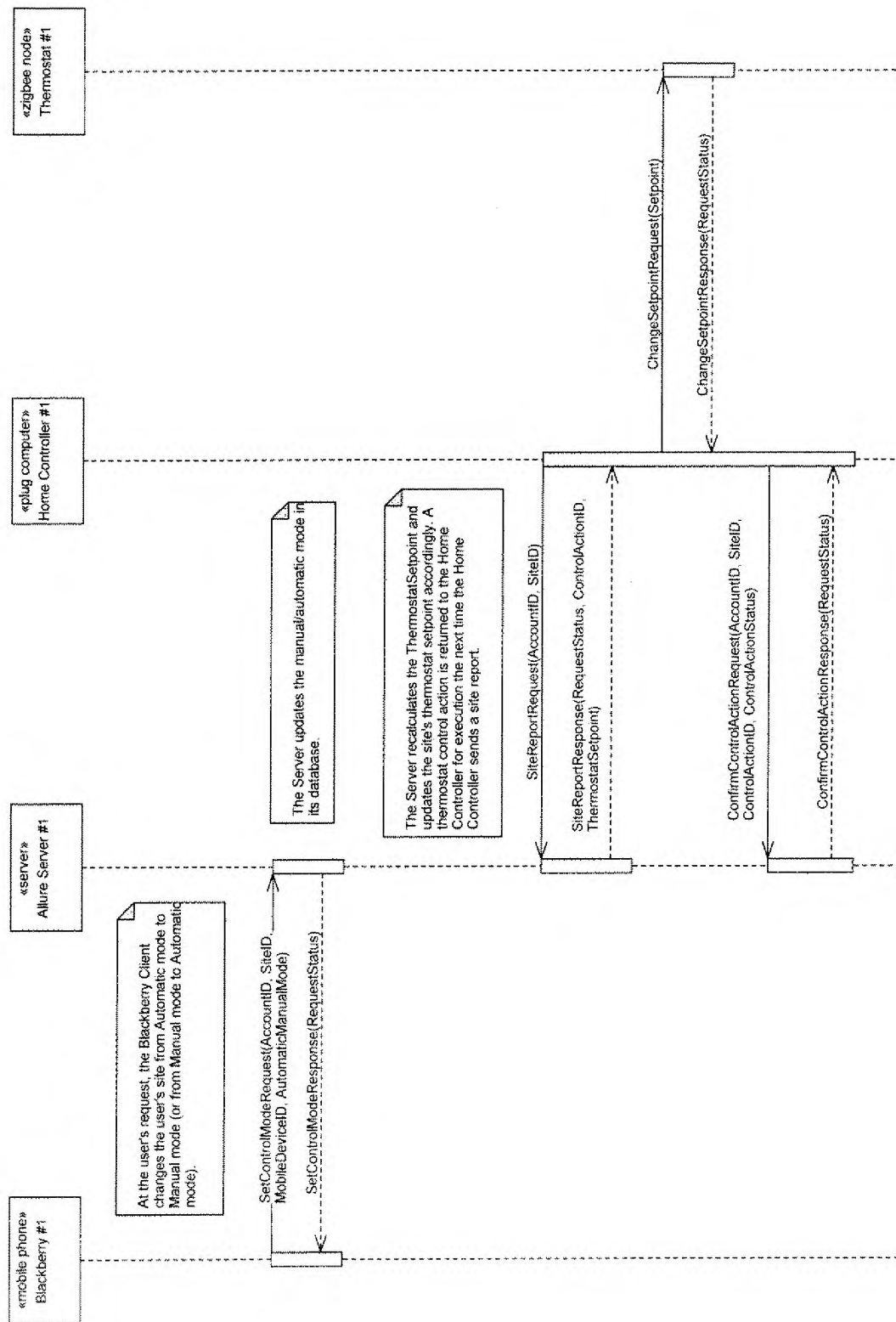
Name: User views latest site data using BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 1:11:54 PM
 Updated: 10/15/2009 5:07:10 PM

Ex. 0



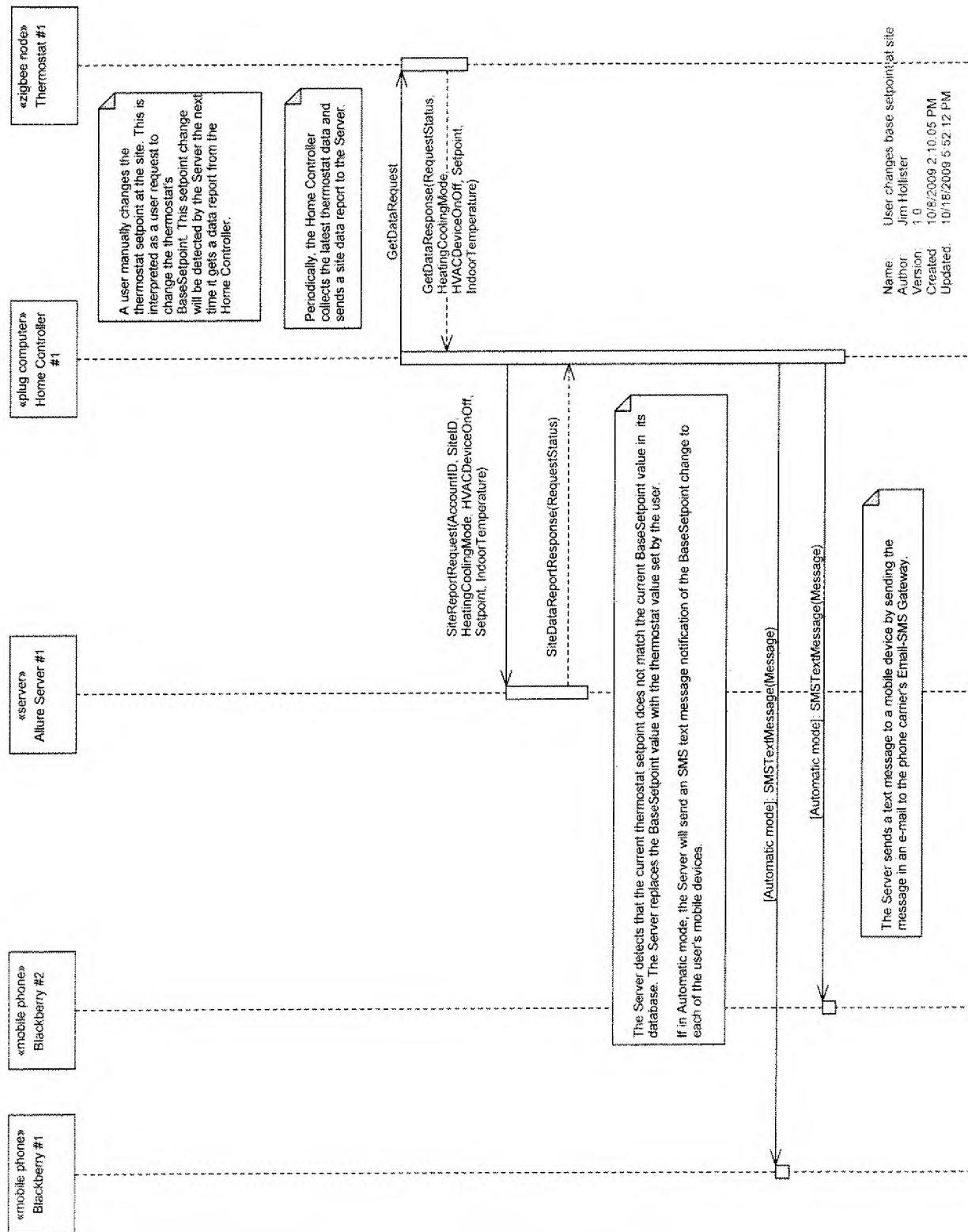
Name: User changes base setpoint using BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 1:23:19 PM
 Updated: 10/18/2009 5:53:48 PM

Ex. P

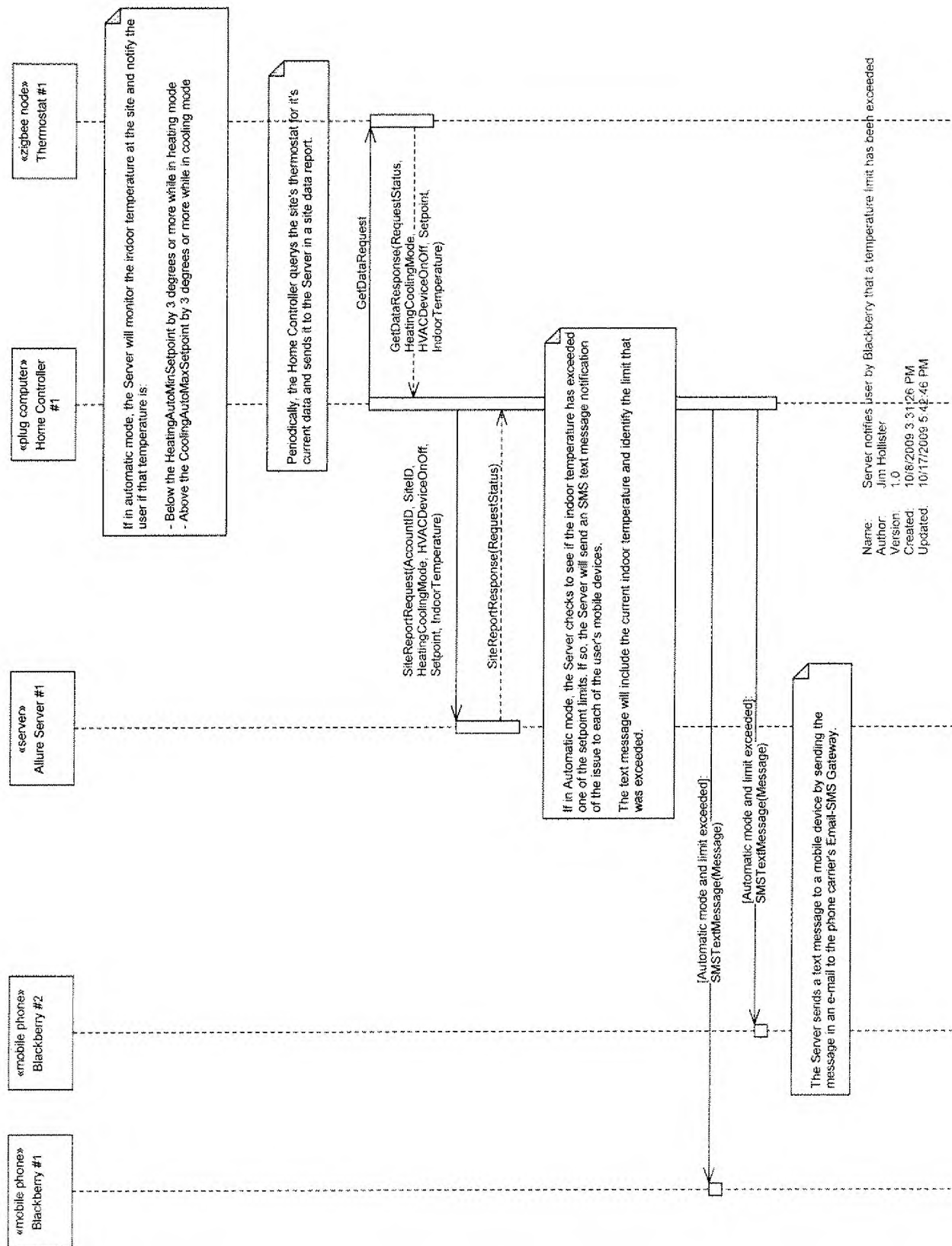


Name: User enables or disables automatic control using BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 1:44:00 PM
 Updated: 10/18/2009 5:55:13 PM

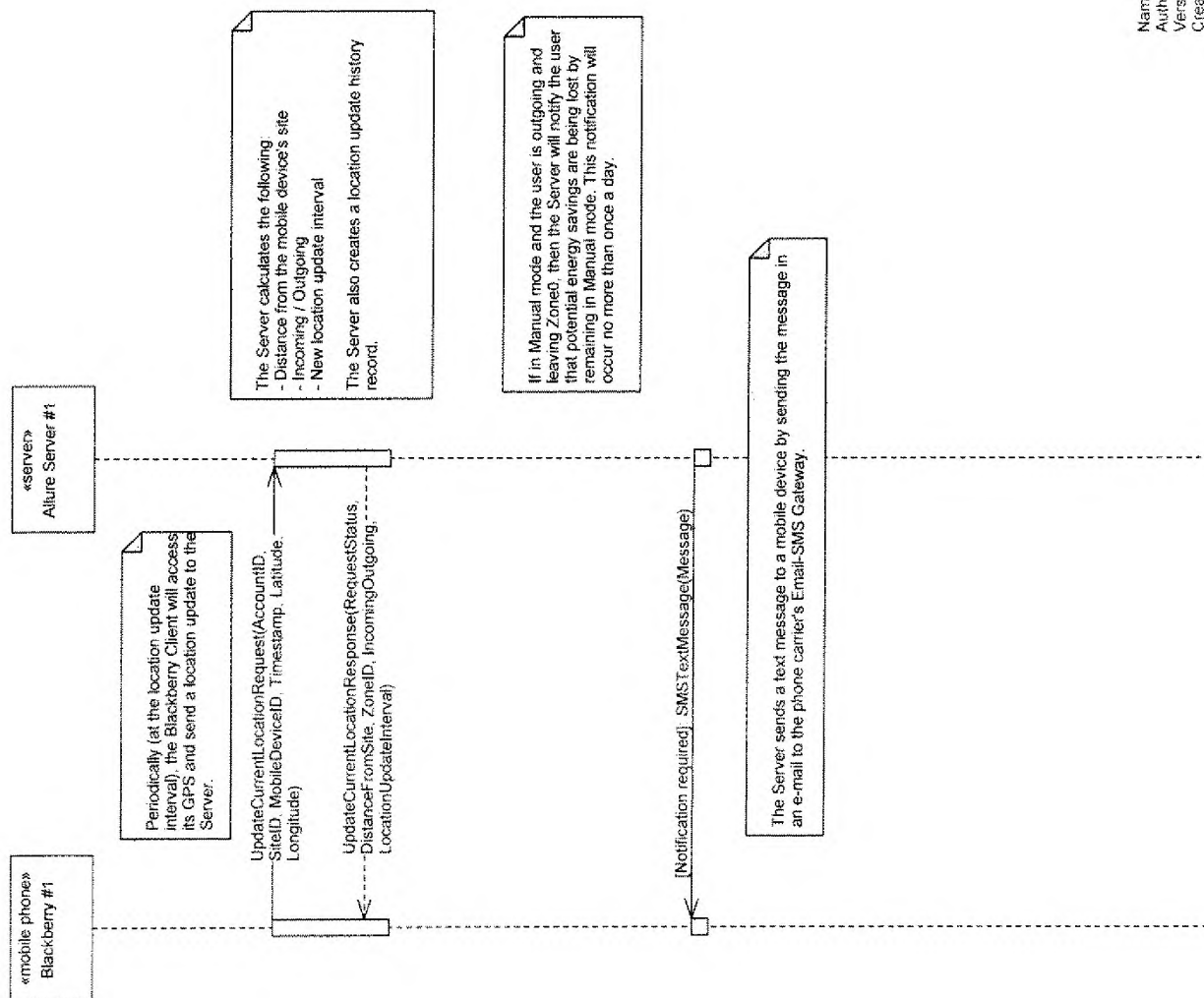
Ex. 0



Ex. R

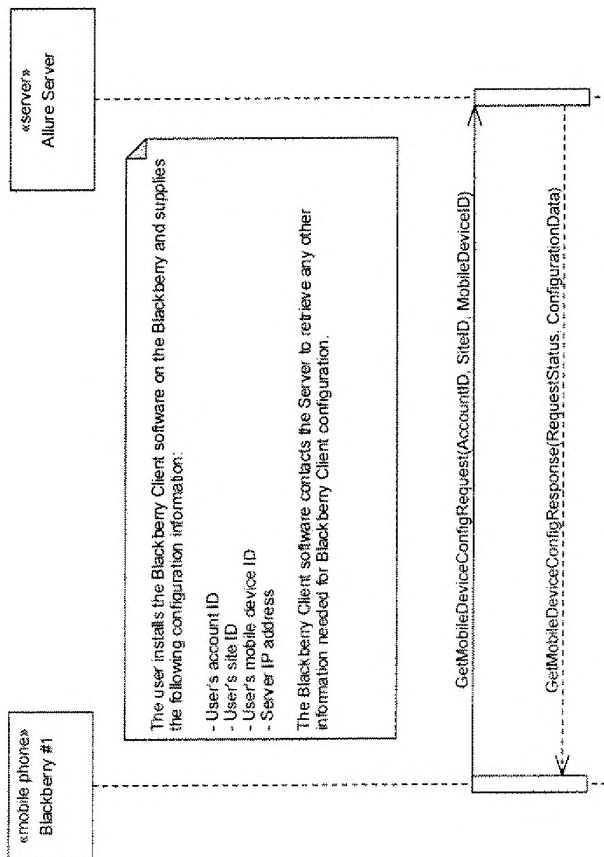


Ex. 5



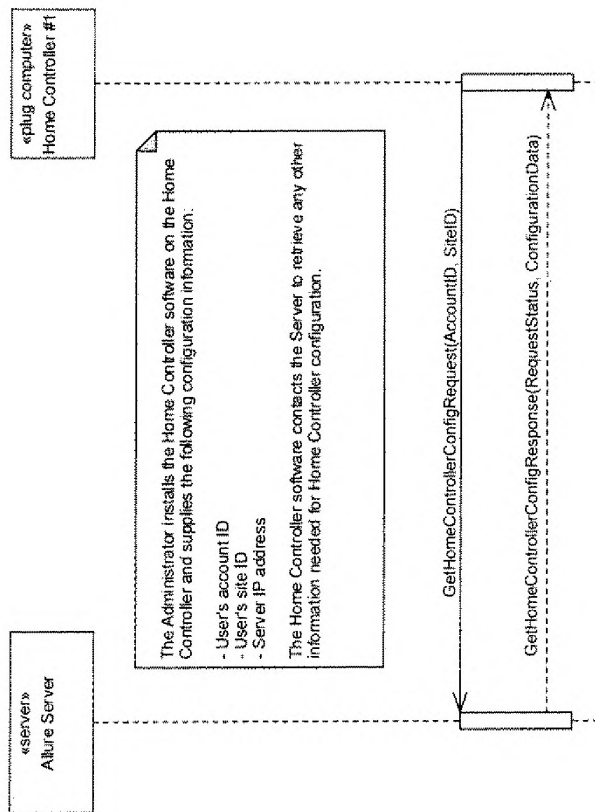
Name: Server notifies user by Blackberry that system is still in manual mode
 Author: Jim Hollister
 Version: 1.0
 Created: 10/8/2009 3:38:49 PM
 Updated: 10/17/2009 5:43:29 PM

Ex. T



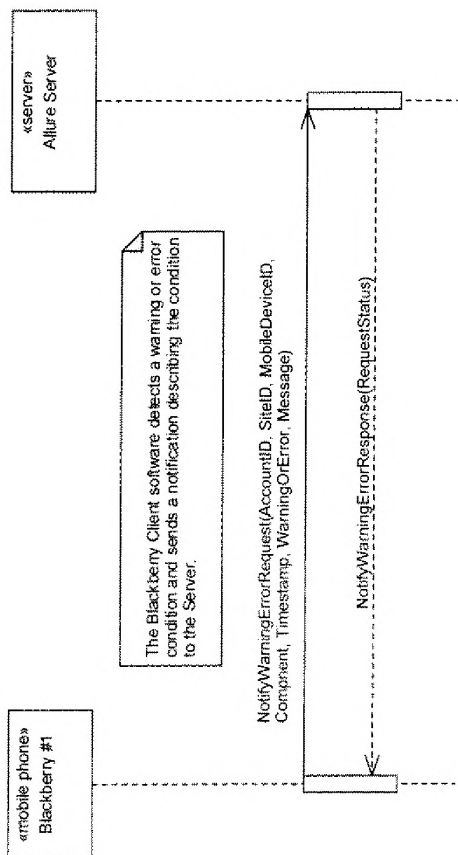
Name: User installs and configures software on BlackBerry
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2003 11:18:18 AM
 Updated: 10/9/2003 11:30:57 AM

Ex. U



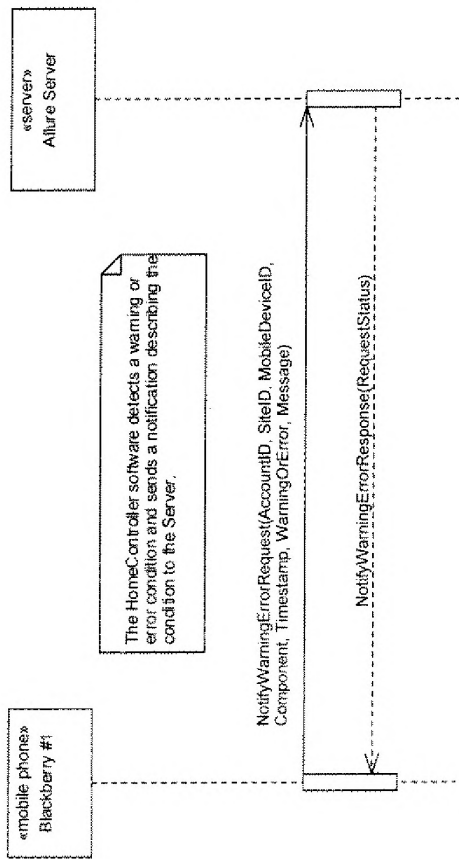
Name: Administrator installs and configures software on Home Controller
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 11:24:58 AM
 Updated: 10/9/2009 11:31:33 AM

Ex. V



Name: BlackBerry notifies Server of warning or error condition
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 4:47:41 PM
 Updated: 10/9/2009 5:03:26 PM

Ex. W



Name: Home Controller notifies Server of warning or error condition
 Author: Jim Hollister
 Version: 1.0
 Created: 10/9/2009 5:02:14 PM
 Updated: 10/9/2009 5:03:34 PM

Ex. X

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		PROXIMITY BASED HOME ENERGY MANAGEMENT SYSTEM AND METHOD		
First Named Inventor/Applicant Name:		KEVIN R. IMES		
Filer:		John S. Artz/Christy Williams		
Attorney Docket Number:		39285-00010		
Filed as Small Entity				
Provisional Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Provisional Application filing fee	2005	1	110	110
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				110

Electronic Acknowledgement Receipt	
EFS ID:	6348928
Application Number:	61255678
International Application Number:	
Confirmation Number:	4915
Title of Invention:	PROXIMITY BASED HOME ENERGY MANAGEMENT SYSTEM AND METHOD
First Named Inventor/Applicant Name:	KEVIN R. IMES
Customer Number:	59582
Filer:	John S. Artz/Christy Williams
Filer Authorized By:	John S. Artz
Attorney Docket Number:	39285-00010
Receipt Date:	28-OCT-2009
Filing Date:	
Time Stamp:	16:28:43
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 110
RAM confirmation Number	2937
Deposit Account	041061
Authorized User	ARTZ,JOHN S.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Provisional Cover Sheet (SB16)	ProvisionalSB.pdf	1000383	no	3
			c5c3e39c844caadf0f2364588992f03d0f18a7b		
Warnings:					
Information:					
2	Specification	Application.pdf	823829	no	21
			cbdff2cb6da67927f835c0fb118424b83fb40de		
Warnings:					
Information:					
3	Drawings-only black and white line drawings	Drawings.pdf	596702	no	24
			5ef0a8b9500d291b29e851878ebfb386f14555af		
Warnings:					
Information:					
4	Fee Worksheet (PTO-875)	fee-info.pdf	29970	no	2
			1fa8618a43c8b64243cb25049b64825285981bbf		
Warnings:					
Information:					
Total Files Size (in bytes):			2450884		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					