

# **P.O.W.E.R.**

Power Outlet for Wireless Power Reporting

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# **The P.O.W.E.R. Project**

## ***Definitions***

Feature: one or more related tasks that add unique functionality to the system

## ***Objective***

The POWER project aims to produce a low cost, low powered, device that will allow home owners to track their power consumption on a per-device basis. The hope is that by allowing home owners to see where all their power is going, they can take steps to disable or replace the most inefficient offenders.

## ***Purpose of This Document***

This document describes the requirements of the P.O.W.E.R. Project. All requirements are high level, with a general overview of how things will work.

## ***Potential Customers***

P.O.W.E.R. is aimed at residential customers. While there is a very large potential for customers in the business world, the initial product will not include any of the features those customers would require.

## **Assumptions and Other Relevant Facts**

For the purpose of this document, we assume several things about the client. We assume:

- They understand their electric bill. This means they know what a kW/hr is
- They have a device that can render web pages that uses heavy javascript. This is the only hardware requirement for the client

## **Functional Requirements**

### ***Satellite***

#### **Introduction**

Satellite refers to the actual power outlet readers of the POWER system. Satellites will make up the wireless sensor network that sends data to the Server, each Satellite will be a node in the network. In appearance, the Satellite will be a box with two sets of prongs that

can fit into National Electricity Manufacturer's Association (NEMA) 5-15 mains electricity outlets, a typical wall outlet in a home or office. The Satellite plugs into both sockets of the wall outlet, and on the opposite side are two NEMA 5-15 sockets. It will sit between the device requiring power and the wall outlet, providing the same number of outlets as the Satellite occupies.

## **Functional Requirements**

The Satellite shall measure current and voltage running through the wall outlets to their respective devices on the other side, and transmit that data to the Server. Transmitting the data will require a low-power communication protocol, as power consumption per Satellite must be under one Watt (1W).

The Satellite shall have a two modes of operation, and these states can be toggled via the Server, or with a button on the outside of the Satellite; one for each outlet. These states are On and Off. In the On state, readings are taken and sent to the Server. In the Off state, the Satellite goes into a super-low power state and cuts power to the device attached to it's output face, effectively making it a remote control for the outlet. Both the button on the side and the Server can override each other, meaning whatever the user is closest to can turn the device on or off. The button shall also cycle through the two indicating modes of the LED on the case.

## **Safety**

The Satellite shall not be able to cause electrical damage or electrical fire to itself or any attached devices, and must be safe for the user to handle. The Satellites shall be encased in such a way that users cannot open them and tamper with them.

## **Scale**

Satellites shall be able to work in groups of up to 255 for any one Server within a 500 meter radius.

## **Power Calculation**

Power will be calculated on the Server. The Satellite is responsible for reporting the current and voltage to the Server. Current and voltage readings must not suffer more than 5% error.

## **Communication**

A low-power communications protocol shall be used, since power consumption is an issue. The protocol used will have the ability to transmit 500 meters (500m).

Transmissions shall occur every 1.0 seconds.

The Satellite's operating modes must be switchable via the Server at any time. If the operating mode button is pressed, the Satellite must send a signal to the Server telling it what state it's going into.

The Satellite shall have a button that when pushed, puts it into a "requesting connection" phase. The "requesting connection" phase will be used to connect the Satellite to the Server. The exact implementation of this is not yet defined.

All communications shall be performed over the Zigbee communication suite.

### **Recap:**

- Ability to plug into standard NEMA 5-15 mains electrical outlets
- Two outlet sockets on the opposite side of the plugs (if it takes up two outlets, it should provide two outlets)
- Less than 5% error on current and voltage reading
- Power draw less than 1W (Watt) per Satellite
- Broadcasts information up to 500m (meters)
- Transmits every 1.0 seconds
- Shall be Zigbee compatible
- Requires encryption on all communication

## ***The Server***

### **Introduction**

The Server sits inside the building being monitored (residence, office, etc) and receives readings from all Satellites that have connected to it. It provides an on-site location to view the data collected. It shall require at most 10W of power. The Server will have a button located somewhere on it that allows it to connect to a Satellite that is in a "requesting connection" phase.

The Server hosts a web server that serves the client static pages (the Display) and provides an API.

## **Functional Requirements**

### ***Hardware***

The Server shall be outfitted with enough processing power and RAM to simultaneously handle the display software as well as receiving all data sent from all Satellites. The Server shall also have enough hard drive space to hold 5 years of data. Currently, the Server specifications are:

- 1.2 GHz CPU, i386 architecture
- 512 MB Ram
- 40G SSD Drive

### ***Load***

The Server shall be able to support up to 255 Satellites. Specifically, the Server must be able to receive a reading from any Satellite at any time. Even if the Server is busy, it must still be able to receive readings in a buffer. Losing readings shall return an error condition and must be dealt with.

### ***Data Readings***

A data reading shall be received by each Satellite once a second. Each data reading must be stored in the database. If data is not received by any operating Satellite, the Server should attempt to receive that missing datum again. If that Satellite is still unaccounted for, it shall be marked by the Server with an error flag and be dealt with by the user. If a Satellite is in Off mode, the Server shall have flags to indicate that in the database.

### ***Communication***

The Server shall have the ability to turn a Satellite Off. These commands issued by the Server must be able to override and be overridden by the button on the Satellite, so that a user can use whichever is closest to change a Satellite's operation.

The Server must be able to connect to the client's network.

All communications shall be performed over the Zigbee communication suite.

### **Recap:**

- Physical Server inside building
- Runs on less than 10W (Watts)
- Hosts Display

- Button to connect nodes
- Ability to connect to the clients network
- Shall be Zigbee compatible
- Requires encryption on all communication

## ***The Display***

### **Introduction**

The Display is the interface that will be used by the client to interact with various features (Asterisks denote optional features):

- User Management
- Group Management\*
- Device Management
- Satellite Management
- View Data
  - View Device Power Consumption
  - View Power Consumption Over Time
  - View Device Cost Over Time\*
- Power Bill Guesstimater\*
- Factory reset
- Software upgrade\*

### **Functional Requirements**

#### ***User Management***

The Display shall include a system to manage users and user permissions. It shall allow the following actions:

- Add users
- Delete users
- Modify user information
- Modify user permissions



The system for managing users will be used to control who can access the system. It will also be responsible for dictating who has permission to modify various attributes of the system.

### ***Group Management\****

The Display should include a system to manage groups and their permissions. A group is a set of permissions that can be applied to a range of users. It should allow the following actions:

- Add groups
- Delete groups
- Modify groups
- Change group permissions

The system for managing groups will be used to augment the user system. It will provide a well known model for system administrators to control user permissions on a large scale.

### ***Device Management***

The Display shall include a system to manage devices. A device is a logical representation of a physical gadget that will consume power. Each device may be plugged into one or zero outlets. When a device is mapped to a different outlet, the history of it's power consumption should follow it.

In addition to devices, the display shall allow the user to create “device groups”. A device group is a logical collection of related devices. A device and a device group can be used interchangeably.

The display shall allow the following actions in regard to device management:

- Add devices
- Disable devices
  - Does not include deleting devices, since that would invalidate history
- Modify devices
  - Rename
  - Change outlet association
- Device Groups\*
  - Device groups are logical groupings of devices that can be viewed as a single device in the view data section

- Create device groups
- Delete device groups
- Modify device groups

The system for managing devices will be used to associate power consumption with user-relevant objects. This will enable the user to identify what power is going to what device.

### ***Satellite Management***

The Display shall include a system to manage associated Satellites. Satellites are the physical outlets that will be monitoring the power consumption of the device related to them.

This system shall allow for the following actions:

- Add Satellites
- Remove Satellite
- Changing the state of associated Satellite
- Changing the reporting frequency of the Satellite

The system for managing Satellites will be used to monitor power consumption and manipulate the Satellite. It is responsible for keeping track of the status of various Satellites and storing the data they provide.

### ***View Data***

The Display shall include several representations of the data that the user can view. The Display shall provide the following views:

- View Device Power Consumption
  - Shows the user power consumption on a per-device basis
- View Power Consumption Over Time
  - Shows the user power consumption over a specified range of time
  - Includes total and per-device power consumption

The Display should provide the following views:

- View Device Cost Over Time\*
  - Shows the user the cost to run a device, or group of devices, over a specified time range
  - Shows the user a comparison of device costs over a specified time range with

a given interval

- i.e.: show them the device cost every month for the past year

The views provided by the system allow the user to actually see the data they are generating using the POWER system. Data must be available in a variety of views. The data will be used to help the user see how much each device is costing them.

### ***Power Bill Guesstimater\****

The Display should provide a system that allows the user to view potential power costs. It should allow for the following views:

- View cost to run a specified device over a period of time in the future
- View cost to run multiple devices over a period of time
- View expected power bill if a device is added

The Power Bill Guesstimater is used by the user to visually show them how much adding or removing devices from their home would cost them. It will help the user see the impact of a decision, such as turning off the light when they leave the room, would save them money in the long run.

In addition to displaying data, the Power Bill Guesstimater module would be responsible for allowing the user to set the cost of electricity in their home. This would require a multi-tiered, lossless system that allows the user to adjust costs of power for:

- Specific time ranges
- Specific power-usage ranges
  - i.e.: Power costs the user \$0.08 per kW/hr for the first 500 kW/hrs, and \$0.10 after that

This system keeps a history of power cost for all future transactions. This must be done because the data should remain the same for a single period of time, even if new conditions arise for all following data.

### ***Factory reset***

The factory reset function is provided to allow the user to reset the system to default settings. This would be useful if the user forgot their password or created a scenario that caused the system to become unusable.

This will require both a form the user can submit through the Display and a physical button.

### ***Software upgrade\****

The “Software upgrade” feature should allow the user to update all software on the server to the newest version. This should be done through the web interface.

### **Recap:**

The Display is the interface that will be used by the client to interact with various features (Asterisks denote optional features):

- User Management
  - Add users
  - Delete users
  - Modify user information
  - Modify user permissions
- Group Management\*
  - Add groups
  - Delete groups
  - Modify groups
  - Group permissions
- Device Management
  - Add devices
  - Disable devices
    - Does not include deleting devices, since that would invalidate history
  - Modify devices
    - Rename
    - Change outlet association
  - Device Groups\*
    - Device groups are logical groupings of devices that can be viewed as a single device in the view data section
    - Create device groups
    - Delete device groups
    - Modify Device groups

- Satellite Management
  - Add Satellites
  - Remove Satellite
  - Changing the state of associated Satellite
  - Changing of the reporting frequency of the Satellite
- View Data
  - View Device Power Consumption
    - Shows the user power consumption on a per-device (or device group) basis
  - View Power Consumption Over Time
    - Shows the user power consumption over a specified range of time
    - Includes total and per-device power consumption
  - View Device Cost Over Time\*
    - Shows the user the cost to run a device, or group of devices, over a specified time range
    - Shows the user a comparison of device costs over a specified range with a given interval
    - i.e.: show them the device cost every month for the past year
- Power Bill Guesstimater\*
  - View cost to run a specified device over a period of time in the future
  - View cost to run multiple devices over a period of time
  - View expected power bill if a device is added
  - Allow the user to specify cost of power for
    - Specific time ranges
    - Specific power-usage ranges
      - i.e.: Power cost the user \$0.08 per kW/hr for the first 500 kW/hrs, and \$0.10 after that
- Factory reset
  - Allow the user to reset the system to default settings via...
    - A form

- A physical button located on the server
- Software upgrade\*
  - Allow the user to upgrade the system to the newest software version

## **Non-functional Requirements**

### ***Satellite***

#### **Aesthetics**

The Satellites shall be of convenient size and shape; specifically, they shall not be obtrusive and shall take up as little space as possible, given the hardware inside them. On each Satellite, there should be:

- A small LED will be located near each socket to indicate power.
- A button for turning the Satellites On or Off.
- A button to initiate connection to the Server

The Satellites shall not be white.

#### **Security**

Data sent from each Satellite to the Server shall be encrypted. This is to prevent intrusion from a third party, be it an adjacent POWER system or an intruder with malicious intent.

The Satellite shall not allow anything except for it's associated Server to trigger the on/off power settings of their outlets.

The Satellites should exist on their own wireless network. This network should be insulated from the outside by the server.

#### **Cost**

The Satellite shall be designed in such a way that adding new Satellites will give the consumer an economically sound cost-to-benefit ratio. Each Satellite should cost less than \$7.50 (USD) to produce. For prototypes, the price will be significantly higher.

#### **Recap:**

- Ability to toggle power through each outlet independently
- Power/activity light
- Costs less than \$7.50 (USD) to produce
- Convenient size
- Attractive and unobtrusive design and color

- Shall not be white

## ***The Server***

### **Aesthetics**

The Server shall be as small and unobtrusive as possible. The Server shall not be white.

### **Encryption**

The Server shall use an encryption method for communication to the Satellites. Connection must be simple enough that an average user can add Satellites at any time.

### **Security**

- There should be no way for the user to log in to the server and get a shell
- Resetting the server to factory defaults using the physical button shall require a paperclip

### **Recap:**

- Not white
- Enough power to respond to any request in less than 500 milliseconds
- No shell access for the user

## ***The Display***

- The display shall be, first and foremost, easy to learn
- No page shall take more than 500 milliseconds to load
- Data should not be lost when a device is moved to a new outlet

### **Security**

The display must provide the following security features:

- Not vulnerable to SQL injection
- Not vulnerable to XSS
- Does not allow unauthorized access
- All data transferred to the display is encrypted



### ***Client Machine Expectations***

Expectations for the clients are very general. It is expected that the client:

- Has a modern web browser
  - Modern meaning IE 9, Chrome 22, or Firefox 15
- Enough RAM and CPU power to render a page in their browser that contains Javascript, images, and extensive mark up

### **Recap:**

- Easy to learn
- Not vulnerable to common web vulnerabilities
- Controlled access
- All data is encrypted

## Use Cases

The following tasks are broken down into several simple steps. Although they do not account for things like “find the button to click”, it is clear when a user is expected to click a button.

The “Actors” section describes the things that will play a role in this scenario. These can include:

- Users
- The display
- The Satellite

The “Assumptions” section describes assumptions that are made for this scenario. These include things such as “User is logged in”, or “Several Satellites are connected”.

The “Procedure” describes the procedure that is taken to by the user to accomplish the goal.

The “Expected outcome” is the ultimate goal. It is what the user expects to happen after they execute the procedure. These can be visual outputs, stored data, or even changes to the way the system behaves.

## ***Logging In***

In this scenario the user logs into the system.

### **Actors**

- User
- System

### **Assumptions**

The user has valid login information

The user has the login page open in their browser

### **Procedure**

The system prompts the user for a username and password

The user enters their username and password

The user clicks a “OK” or “Submit” button

The system logs the user in

### **Expected outcome**

The user is now logged in.

## ***Logging Out***

In this scenario the user logs out of the system.

### **Actors**

- User
- System

### **Assumptions**

The user is logged in

The user is on any page

### **Procedure**

The user clicks the logout button

The system logs the user out

The display informs the user that they have been logged out

The system returns the user to the login page

### **Expected outcome**

The user is now logged out.

## ***View Monthly Power Consumption***

In this scenario the user is intending to view the power consumption of the entire house for a series of specified consecutive months.

### **Actors**

- User
- Display
- System

### **Assumptions**

The user is logged into the display site

The user is at the home page

The system has logged data from at least one month ago

### **Procedure**

The user clicks the "View Data" button in the navigation menu

The display opens a drop-down menu with several more links

- One of which is "View Device Power Consumption"

The user selects "View Device Power Consumption"

The user specifies the date range that will viewed

The user clicks a "OK" or "Submit" button

The display shows the user a table containing:

- The name of the month
- The total power consumed by the entire system for that month
- The site displays the sum of the power consumption for each Satellite on each day of the month

### **Expected outcome**

The site will display the power consumption from the specified month or a warning if the data does not exist.

## ***View Largest Power Consumer***

This use case describes the process that a user would employ to display a list of the largest power consumers being recorded by the system.

### **Actors**

- User
- Display

### **Assumptions**

The user is logged in and on the home page

There are several devices associated with the Server

### **Procedure**

The user clicks the "View Data" button from the navigation menu

The display opens a drop-down menu with several more links

- One of which is "Device Power Consumption"

The user selects "Device Power Consumption"

The display shows the user a table containing:

- The name of each device
- The power consumed by each device
- The device's power consumption per hour
- Sorted alphabetically by name

The user clicks on the "Power consumed" column to sort it from greatest to least

The display sorts the list from greatest power consumption to least

### **Expected outcome**

The user sees that the first item in the list is using the most power.

The user sees the next few largest power-consuming devices.

## ***View Power Consumption Over Time***

This use case describes the process that a user would employ to display graphs indicating the power consumption of devices over a specified time range.

### **Actors**

- User
- Display

### **Assumptions**

The user is logged in and on the home page

There are several devices associated with the Server

The Server has several months worth of data

### **Procedure**

The user selected the "View Data" button from the navigation menu

The display shows the user a list of charts they can view

- One of which is "View Power Use over Time"

The display shows a page that prompts the user to select:

- What devices or device groups they want to compare
  - Defaults the group "All devices"
- What time period they would like to compare them over
  - Defaults to the last six months

The user supplies the requested information

The user clicks "Display"

The display generates one chart for each device/device group over the specified range

Displays them in the order the user selected them

### **Expected outcome**

The user sees the power consumption trends of the selected devices over the selected time period

## ***Adjust Power Cost***

This use case describes the process that a user would employ to change the cost-per-kilowatt-hour that the system uses to guesstimate the monthly power bill.

### **Actors**

- User
- Display

### **Assumptions**

The user is logged in and on the home page

The user has permission to change the kilowatt/hr cost

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Adjust Power Cost" page

The user clicks the "Adjust Power Cost" link

The display presents the user with a page consisting of two columns of text boxes. The left column indicates the range for the cost, which is specified in the right column

- The goal is to allow the user to say "My first 500 kW/hrs cost \$0.08, my next 1000 kW/hrs cost \$0.10, and everything after that costs \$0.12 per kW/hr"

The user adjusts the cost by changing the ranges or changing the costs

The user clicks a "Submit" button

The display shows the changed power costs

### **Expected outcome**

The display applies the changed power costs to all new calculations. Previous calculations shall remain unchanged, with assumption that costs just increased.



## **Add User**

This use case documents the procedure that a user would use to add a new user.

### **Actors**

- User
- Display

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify user permissions

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "User Management" page

The user clicks the "User Management" link

The display shows the user the "User Management" page

- This includes a button to add a user

The user clicks "Add user"

The display presents the user with a page that contains the necessary fields to create a new user:

- First name
- Last name
- Username
- Password
- A check-box requiring the user to change their password at login
- A multi-select to put them into groups
- A list of permissions to give the user

The user supplies the requested information

The user clicks a "Submit" button

The display informs the user that the user has been added

The display shows the user the "User Management" page

### **Expected outcome**

A new user was added with the requested username, password, and permissions.

## ***Delete User***

This use case documents the procedure that a user would use to delete a user.

### **Actors**

- User
- Display

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify user permissions

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "User Management" page

The user clicks the "User Management" link

The display shows the user the "User Management" page

- This includes a button to delete a user

The display presents the user with a list of users with check-boxes next to their usernames

The user then clicks on the check-box next to appropriate username

The user clicks "Delete user"

The display shows a dialog box asking to confirm the delete

The user clicks on "Apply action"

The display informs the user that the user has been deleted

The display shows the user the "User Management" page

### **Expected Outcome**

A user was deleted from the system by another authorized user.

## **Add Device**

This use case documents the procedure that a user would use to add a new device to the system.

### **Actors**

- User
- Display
- Device

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify devices

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Device Management" page

The user clicks the "Device Management" link

The display shows the user the "Device Management" page

- This includes an "Add device" button

The user clicks the "Add device" button

The display prompts the user for information about the device, including:

- Name
  - Optional: room, location in room, owner. These will be used to guide the user in coming up with a unique name
- What Satellite it is plugged into
  - Optional, may be not be plugged in

The user fills in the requested information

The user clicks an "OK" or "Submit" button

The display informs the user that the device has been added

The display shows the user the "Device Management" page

**Expected outcome**

The display has the device available for history and mapping to Satellites.

## ***Rename Device***

This use case documents the procedure that a user would use to rename a device associated with an outlet.

### **Actors**

- User
- Display
- Device

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify outlet-device mappings

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Device Management" page

The user clicks the "Device Management" link

The display shows the user the "Device Management" page

- This includes a list of all existing devices

The user clicks on the row of the device they want to edit

The display presents a page with a form that allows the user to edit the name of the device

The user changes the name of the device

The user clicks "Submit" or "Save"

The display informs the user that the device has been renamed

The display shows the user the "User Management" page

### **Expected outcome**

The device is now know by a new name.

## ***Disable Device***

This use case documents the procedure that a user would use to disable a device.

### **Actors**

- User
- Display
- Device

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify devices

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Device Management" page

The user clicks the "Device Management" link

The display shows the user the "Device Management" page

- This includes a drop down with an action to disable a device
- This includes a table listing all the devices, with check-boxes next to each row

The user selects the "Disable Device" action

The user then clicks on the check-boxes next to appropriate devices

The user clicks an "OK" or "Submit" or "Apply" button

The display shows a dialog box asking to confirm applying the action

The user clicks on "Apply action"

The display informs the user that the device has been disabled

The display shows the user the "Device Management" page

### **Expected Outcome**

A device was disabled and will no longer appear in any menus.

## ***Re-enable Device***

This use case documents the procedure that a user would use to re-enable a device.

### **Actors**

- User
- Display
- Device

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify devices

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Device Management" page

The user clicks the "Device Management" link

The display shows the user the "Device Management" page

- This includes a link to a "Disabled device Management" page

The user clicks on the "Disabled device Management" link

The display shows the user the "Disabled device Management" page

- This includes a drop down with an action to re-enable a device
- This includes a table listing all the devices, with check-boxes next to each row

The user selects the "Re-enable Device" action

The user then clicks on the check-boxes next to appropriate devices

The user clicks an "OK" or "Submit" or "Apply" button

The display shows a dialog box asking to confirm applying the action

The user clicks on "Apply action"

The display informs the user that the device has been re-enabled

The display shows the user the "Device Management" page



**Expected Outcome**

A disabled device was re-enabled and will appear in all menus.

## ***Remap Device***

This use case documents the procedure that a user would use to associate a device with a Satellite.

### **Actors**

- User
- Display
- Satellite

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify Satellites and modify devices

The device has been created

The Satellite has been associated with the display

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Device Management" page

The user clicks the " Device Management" link

The display shows the user the " Device Management" page

- This includes a table listing all the Satellites

The user clicks on the row of the device they wish to associate with a Satellite

The display shows the user a page that contains information about the selected device

- Including a drop down that allows the user to select the associated Satellite

The user selects the Satellite the device is plugged into from the drop down

The user clicks a "OK" or "Submit" button

The display informs the user that device has been updated

The display shows the user the "Device Management" page

**Expected outcome**

The device has been associated with a new Satellite, and all data from that Satellite will be attributed to the specified device.

## ***Adding a Satellite***

This use case documents the procedure that a user would use to associate a new Satellite with the display.

### **Actors**

- User
- Display
- Satellite

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify Satellites

The user has plugged the Satellite into the wall

Everything goes according to plan

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Satellite Management" page

The user clicks the "Satellite Management" link

The display shows the user the "Satellite Management" page

- This includes an "Add Satellite" button

The user clicks the "Add Satellite" button

The display prompts the user to press the "Connect" button on the Satellite and then click "OK"

The user presses the "Connect" button on the Satellite

The display informs the user that it's searching

The display then displays the serial number (xxx-xxx) of the connected Satellite

The user confirms that this is the correct Satellite

The display shall inform the user that a new Satellite was connected

The display shows the user the "Satellite Management" page

**Expected outcome**

A new Satellite was added to the display.

## ***Removing a Satellite***

This use case documents the procedure that a user would use to remove a Satellite with the display.

### **Actors**

- User
- Display
- Satellite

### **Assumptions**

The user is logged in and on the home page

The user has permission to modify Satellites

The Satellites being removed do not have any devices associated with them

### **Procedure**

The user clicks the "Settings" link from the navigation menu

The display presents the user with the settings panel, which includes a link to the "Satellite Management" page

The user clicks the "Satellite Management" link

The display shows the user the "Satellite Management" page

- This includes a drop down with an action to remove Satellites
- This includes a table listing all the Satellites, with check-boxes next to each row

The user clicks on the appropriate check-boxes next to the Satellites

The user selects the "Remove Satellite" action from the drop down menu

The user clicks "Apply" or "OK"

The display prompts user to confirm the removal

The user clicks "Submit" or "OK"

The display informs the user that the Satellites were removed

The display shows the user the "Satellite Management" page

**Expected outcome**

The specified Satellites have been removed from the display. No historical data should have been lost due to this procedure.

## ***\*Adding A Satellite – Physical Setup***

This use case documents the procedure that a user would use to associate a new Satellite with the display, using the physical setup button.

### **Actors**

- User
- Server
- Satellite

### **Assumptions**

The user has plugged the Satellite into the wall

The user has the Server running under normal conditions

### **Procedure**

The user must press the "Connect" button on the Satellite's case

The user must press the "Connect" button on the Server's case

### **Expected Outcome**

The Satellite and Server should go through handshaking and after no more than 10 seconds, shall be connected.



## ***\*Cycling Power Modes***

In this scenario, the user intends to test the functionality of the two Operating Mode buttons on the case of the Satellite.

### **Actors**

- User
- Satellite
- Server
- Display

### **Assumptions**

The Satellite is On

The Satellite is connected to the Server

The Server is running normally

The Display is running normally and is on a page that can view the operating status of the Satellite being interacted with

### **Procedure**

The user looks at the Display

- The Display should show the Satellites outlets in question sending current readings

The user must toggle the “Toggle Power” button for each outlet face twice, with at least a 2 second pause between button presses

- The user looks at the Display again
  - If this display page is not real-time, the user must reload the page

### **Expected Outcomes**

The user should see on the Display:

A section of readings from that Satellite that shows actual data

A section of readings from that Satellite that indicate "Off" mode

The devices connected to the Satellite, if any, should be off when the Satellite is in "Off" mode

### ***\*Plug In Satellite***

This use case describes the process a user must employ to plug in the Satellite.

#### **Actors**

- User
- Satellite

#### **Assumptions**

The power outlet in question is wired to mains electricity

The power outlet is NEMA 5-15 standard

The user is next to the outlet

#### **Procedure**

The user picks the Satellite up in their hand

The user orients the Satellite with the holes of the power outlet

The user presses the Satellite in until it is flush with the wall

The user plugs devices into the outlet faces of the Satellite

#### **Expected Outcome**

The devices attached to the Satellite's outward face operate normally

The Satellite's power indicator light is on and solid (not blinking)

## ***\*Power Up the Server***

This use case describes the process a user must employ who intends to power up the Server.

### **Actors**

- User
- Server
- Display

### **Assumptions**

The Server is initially shut down

The outlet mentioned is functioning

### **Procedure**

The user picks up the power plug for the Server

The user plugs it into the wall

The user makes any other necessary connections (Ethernet)

The user presses the power button on the Server

### **Expected Outcome**

The Server will be indicating that it has been powered up

The Display should be operating and accessible after no more than 3 minutes of startup time