Use Case Name: Register New User

Summary: Client will be able to register a new user profile and add pertinent information.

Basic Course of Events:

1. Client clicks button to register new user.
2. The page redirects to another page to input basic user information, such as username, password, and Full Name.
3. The information submitted will be saved onto the database for login information.
4. The client clicks next button to submit more information required.
5. The page redirects to another page to input Building Layout, as well as pertinent information related to utilities (Utility Administrator email, utility provider, and provide a utility bill budget target). The Building Layout will consist of monocolor floor plans / blueprints for machine learning color coding by cluster.
6. Information will be saved onto the database for machine learning data analysis, and used for graphics and energy-use suggestions.
7. The client clicks the next button to submit more information required.
8. The page redirects to another page to register smart devices, and to define clusters/groups. These clusters will later be used to identify specific areas for power usage comparison.
9. Information will be saved and be used for machine learning data analysis, and will provide future functionality on the Dashboard.
10. The client clicks the Done button, and is redirected to the homepage / dashboard.

Alternative Paths: None

Exception Paths: In step 2, if illegal characters are used, or username/password requirements are not fulfilled, the page will reload and will ask to resubmit information without illegal characters/ to fulfill requirements. The submitted password will have a length requirement of at least 8 characters. In step 5, if an unreadable Building Layout format is submitted, or any invalid information pertaining utilities is submitted, the page will reload and ask to re-submit information.

Extension Points: User will be able to go back and edit information submitted through an option on the dashboard

Trigger: The user wants to register a new profile.

Assumptions: The user has access to pertinent utility, smart device, and building layout information.

Precondition: The database has been established and can receive multiple forms of information.

Postcondition: The user has created a new login profile.

Author: Walktime Error

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Use Case Name: User Login
Summary: User will be able to login using existing profile information.
Basic Course of Events:

1. User clicks a button to redirect to a login Page.
2. The Page will ask for username and password.
3. User submits username and password.
4. The database will verify the username and password.
5. The page will redirect to website dashboard.

Alternative Paths: If the user does not accurately submit username and/or password after 5 tries, the user is locked from attempting to log in for 30 minutes.
Exception Paths: In step 3, if user does not submit correct username and/or password, the page will reload and ask user to resubmit. (Display login error)
Extension Points: None
Trigger: User wants to log in to use application.
Assumptions: User has already registered a profile and has submitted pertinent information.
Precondition: The database is able to verify login credentials.
Postcondition: The login information has been accepted and the user can now proceed.
Author: Walktime Error
Date: June 15th, 2018

Use Case Name: Dashboard Display Functionality
Summary: After logging in, the user will see and be able to use all dashboard functionalities.
Basic Course of Events:

1. The user successfully logs in, and can see the functions placed on the dashboard.
2. The user has the option to:
    a. Control Building's Smart Lights
    b. Display Graphs of Energy Consumption
    c. Display Building Graphic depicting power usage.
    d. Change profile settings
    e. Log out

Alternative Paths: From Step 2a, the user has the option to dim/brighten or power on/off Lights immediately, whether in defined cluster, or individual bulbs. Defined Clusters and registered smart devices will come from the user's submitted profile information. From Step 2b, user can view graphs or charts of energy consumption, created by the system. User can choose to categorize the information provided by Daily, Weekly, or Monthly, Annually.

Information will come from the user's submitted profile information and information stored in the database through a period of time. From Step 2c, the user can view a graphic depicting the Building schematics, displaying power usage per building (color-coded). The building schematics will be retrieved from the submitted building information within the user's profile. From Step 2d, the user can edit submitted information in their profile, change password, or change profile settings. From here, the user can also redefine existent bulb clusters, as well as register new smart devices. The user can then click a button to save edited information, and will return to the Dashboard. From Step 2e, User will be logged out and will no longer be able to access the dashboard interface.

Exception Paths: None

Extension Points: From Steps 2a-d, the user will have access to a button that allows them to return to the dashboard. In regards to Step 2d, pressing this back button will not save edited information and a notification will be generated for the user.

Trigger: The user wants to access dashboard functionalities.

Assumptions: The login has been successful, thus allowing user to access dashboard.

Precondition: The front-end and back-end functionalties have been linked at their appropriate places. Information is able to be edited through the profile settings and the edits will change within the database. The machine learning system has already been set up (gone through all submitted information), and graphics have been produced based off of said information.

Postcondition: User is able to use all dashboard functionalities and is able to log off.

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Use Case Name: Database Functionality

Summary: The Database will store all information pertaining to the energy consumption of client's assets and employee login credentials. Thus it will provide support to the front end applications.

Basic Course of Events:

1. Hourly energy consumption measures from installed meters would be recorded and updated in the database.
2. When a new user registers, the employee's ID, username and password will be saved in the database
3. When a user tries to login, the rows in the database will be searched sequentially to validate the user's credentials
4. When creating a prediction model, the data held in the database will be used in a systematic manner.

Alternative Paths: For Task 1, data collected from installed meters would be inserted to the database through automated scripts. In case, of corrupted data or data not meeting the database integrity, that particular record will be discarded and this action will be recorded in a log along with the reason for discarding the data. For Task 2, user information must meet the requirements specified in the database. Ineligible usernames and/or passwords would be rejected and this will trigger an alert to be sent in the form of a message to the user. For Task 3, information collected from user input would be scanned against all records in the Employee table for a match. In case of a match found a success message would be triggered. In case of no match, a failure message would be triggered for the user. For Task 4, the database would act as a source for the information needed by the Machine learning algorithms.
Exception Paths: Invalid or corrupted data.
Extension Points: Regular scheduled backups setup for the client
Trigger: Any information that needs to be saved or retrieved.
Assumptions: The database schema functions as desired and data is not corrupted.
Precondition: Database schema is setup properly with intended dependencies.
Postcondition: Data can be stored and retrieved with no unexpected delays
Author: Walktime Error
Date: June 15th, 2018

Use Case Name: Smart Bulb API Functionality
Summary: Using the Phillips Hue Smart Bulb API, functions will be integrated within the machine learning system, as well as the website.
Basic Course of Events:

1. Setup between the bridge and bulbs, and the network to ensure the devices are functioning properly.
2. Establish a connection between Smart Devices, and the Hue App API.
3. Apply methods within the API to create functions desired for machine learning and website functionality.

Alternative Paths: From step 3, multiple functions need to be created. The first function required is the ability to register devices individually and define clusters. The second function is to give our system access to be able to remotely toggle and change intensity of bulb clusters. The third function is to create a readable and storable format for wattage output of bulb clusters, to implement this information within our machine learning system.

Exception Paths: Bulb information regarding wattage is unreadable to the machine learning system, which function must be re-evaluated to output desirable information. The room/cluster

of bulbs have been remotely toggled while there is occupancy, which occupants can manually reset by toggling the wall switch, or through the smartphone app.
Extension Points: User must be able to redefine clusters, as well as register new smart devices.
Trigger: The User would like to remotely toggle lights, and have wattage information available to be compared between clusters and buildings.
Assumptions: The Phillips Hue API is open and readily available to use.
Precondition: Access to the Phillips Hue API, Places where Smart Bulbs are implemented have a wall switch that remains in the On position.
Postcondition: Desired functions readily working for machine learning process, website functionality, and smart device registration.
Author: Walktime Error
Date: June 15th, 2018

Use Case Name: Machine Learning Functionality
Summary: Provide Machine Learning features to the user such as notifying of unusually high energy consumption in any particular area.
Basic Course of Events:
A substantial amount of training data is stored in the database. Then using a chosen Machine Learning Algorithm, a prediction model is produced. An accuracy score is also derived from the training data. The process is repeated for multiple algorithms until the best suited algorithm with the highest accuracy is obtained. Once the algorithm is selected, the prediction model produced by the algorithm is used to predict future instances. For example, when the system is trained in the described manner into knowing the energy consumption of a building at any particular hour, the next time the system is given the consumption within 15 mins, it would be able to predict if there will be an over consumption, average consumption or low consumption by the end of the hour. This way the system can alert the user so that the user may choose to take action immediately and save precious energy.
Alternative Paths: Every hour, at a certain predetermined time, the system will automatically run a few selected algorithms against the available dataset and determine the best algorithm based on accuracy. Once it has determined the algorithm, it will then store the prediction model and use that model to predict the outcome at the end of the hour. If the prediction is lower than or within the threshold then no action is taken until the next hour when the process is repeated. If the prediction is higher than the threshold then the system triggers an alert and starts the process of notifying the user of the anticipated high consumption and the possible steps that may be taken. After that the system again waits for the next hour to repeat the process.

Exception Paths: None of the algorithms might produce an accurate enough result which may be depended upon.
Extension Points: The user may also be advised on which devices are having the highest consumption rate.
Trigger: A schedule may be set for the system to start this entire process.
Assumptions: The Machine Learning kit functions as desired and produces accurate predictions.
Precondition: The training data is clean and vast enough for optimal results.
Postcondition: The system is able to predict the energy consumption outcome by the end of the hour.
Author: Walktime Error
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