Software Requirements Specification (SRS) Document
Energy Monitoring And Control In Kohli Research Block
Team 5

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1 Brief Problem Statement

To monitor and control air conditioning system in Kohli Research Block via a user friendly website integrated with an alarm system.

1.1 Problem Statement and Scope

Energy conservation is the effort made to reduce the consumption of energy. This can be achieved either by using energy more efficiently or by reducing the amount of service used. Energy conservation reduces the need for energy services and can result in increased environmental quality, national security, personal financial security and higher savings.

1.2 Purpose of the System

This project is expected to monitor the temperature of each laboratory in KRB and generate useful analytics , graphical data and heat maps that indicate energy consumption by the air conditioning systems.The project will have an integrated control system as well that can be used to change the state of individual AC units and adjust their temperature as well.

Together, the control and monitoring components will be used to implement an energy saving system.

2 System Requirements

2.1 Hardware

1. **Daikin D-BACS**
   This system is interfaced with all the air conditioning units in KRB. It gives info about the running status of all the AC's in every laboratory of the building.The D-BACS BACnet gateway will be accessed using at protected IP address and port via the LAN connection available in the 4th floor of the KCIS building.

2.2 Technical Stack

1. **BACnet and Python**
   These are the languages that will be used to interact with the Daikin D-BACS system.

2. **MongoDB**
   Used to make the database that is required to store all the data received from D-BACS system. Used for easy integration with Python.

3. **HTML, CSS and Javascript**
   Languages required to design and create the frontend of the webpage containing the dashboard.

4. **OneM2M**
   Real-time data obtained from the occupancy sensors will be pushed onto OneM2M/ or the MongoDB database

5. **MERN Stack**
   The web application will be developed using the MERN Stack. The user interacts with the ReactJS UI components at the application front-end residing in the browser. This frontend is served by the application backend residing in a server, through ExpressJS running on top of NodeJS.

   Any interaction that causes a data change request is sent to the NodeJS based Express server, which grabs data from the MongoDB database if required, and returns the data to the frontend of the application, which is then presented to the user.

3 User Profiles

This project dashboard has three kinds of users, namely,

1. **Space User**
   These users are the researchers working in the labs in KRB. They can access data and control AC's of their own lab. Each user will have a login ID and a password and will belong to a particular lab.

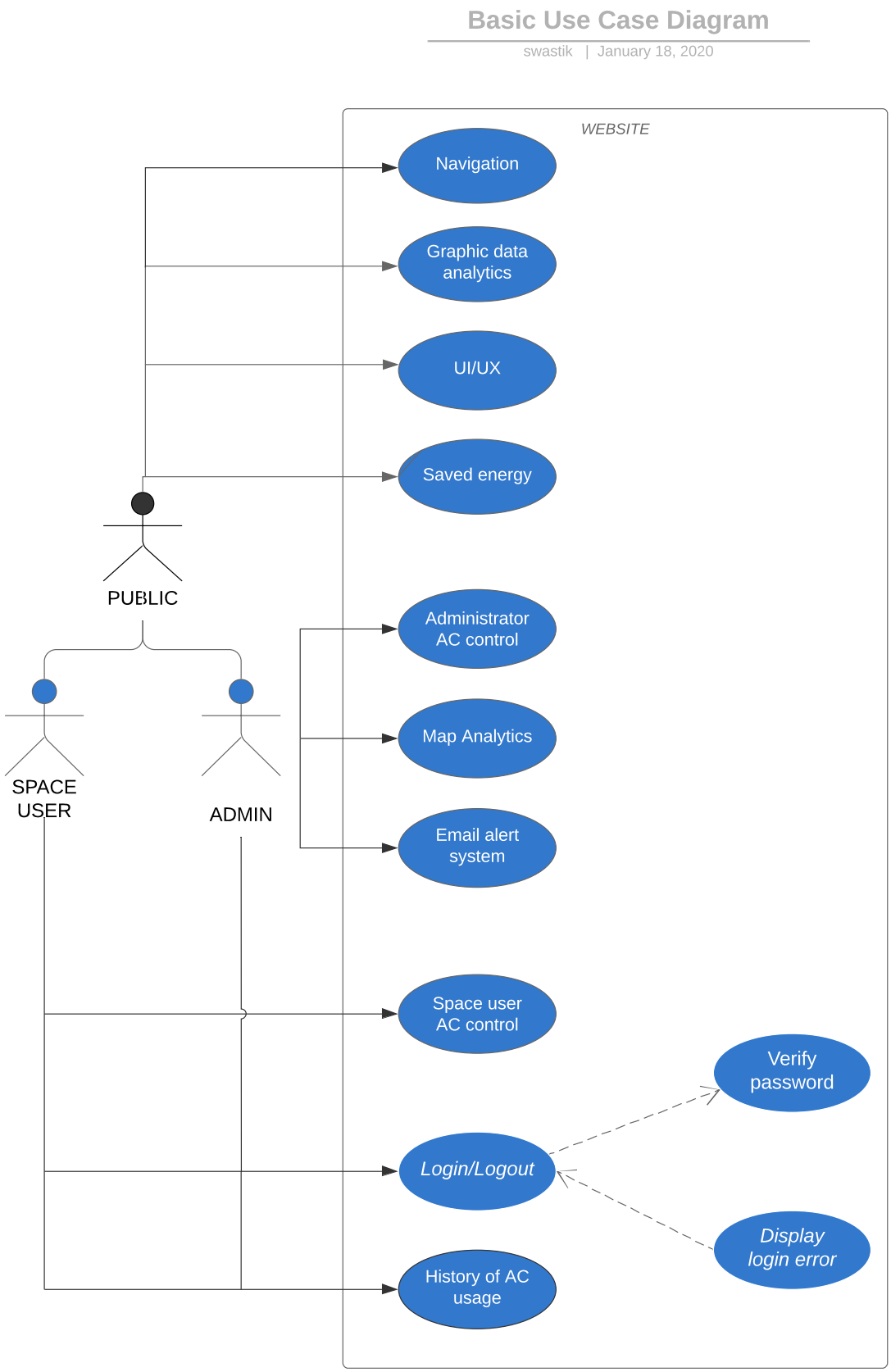
2. **Super User/ Admin**
   The administrator can access data of every lab in KRB and can also control all the air conditioning system.There will be only one admin .Admin will have a login ID and password.

3. **Public User** This user can access common public dashboard to show the overall energy consumption, average temperature , and other analytics related to the data collected over time.

4 Feature Requirements

Number	Use Case Name	Description	Release
1	UI/UX	User friendly UI/UX with pleasant colour scheme is made accessible to the users.	R1
2	Login/Logout	Space users and Administrators need to be able to access password protected data.	R1
3	Navigation	Users must be able to navigate between the accessible pages of the dashboard	R1
4	History of AC Usage	AC usage intervals and the corresponding temperature and energy consumed can be viewed.	R2
5	Administrator AC Control	Administrators need to be able to control the AC of all the labs present in KRB.	R2
6	Space user AC Control	Space User needs to be able to control the AC of his/her labs.	R2
7	Graphical Data Analytics	Graphs of energy consumption, AC temperature versus time.	R2
8	Map Analytics	Maps of temperature and energy consumption across the entirety of KRB.	R2
9	Email Alert System	Email alert is sent to the heads of respective labs when there is overuse of AC system.	R2
10	Saved Energy	Calculate and display the energy saved due the alert system implemented by the project.	R2

5 UML Diagram



6 Use Case Description

Use Case Number	UC-01
Use Case Name	UI/UX
Overview	User friendly UI/UX is made accessible to the users.
Actors	All users
Pre-Condition	Launch Flask application/ Load website
Flow	1. Smooth scrolling through graphical data and maps. 2. Smooth changes in colors and gradients.
Post Condition	Termination of the application.

Use Case Number	UC-02
Use Case Name	Login/Logout
Overview	Login requires registered users to provide username and password.Space users and super users are required to login to access their respective dashboards.
Actors	Super User, Space User
Pre-Condition	Registration
Flow	1.Accept username and password 2. Check if they exist in the database, and throw error if not 3. If they exist, load the appropriate web page based on permissions.
Post Condition	Access to user specific dashboard.

Use Case Number	UC-03
Use Case Name	Navigation
Overview	Navigation with links to three dashboards as well as sign in and register links and link to the homepage
Actors	All users
Pre-Condition	Launch Flask Application/ Load website
Flow	1. Navigation bar will have options that highlight on hovering 2. Dashboard/Login page opens up in the same tab on-clicking
Post Condition	View/Control access to appropriate dashboard or login/registration page

Use Case Number	UC-04
Use Case Name	History of AC Usage
Overview	AC usage intervals and the corresponding temperature and energy consumed over the past week can be viewed
Actors	Space users, Super users
Pre-Condition	Login authentication
Flow	1. After login data is validated the space user will be shown data of his/her laboratory and the super user of the entire block 2. Time graphs of temperature and energy data over the past week are displayed.
Post Condition	The user will have to logout after his/her session

Use Case Number	UC-05
Use Case Name	Administrator AC Control
Overview	Administrators need to be able to control the running state of ACs of all the labs present in KRB.
Actors	Super User
Pre-Condition	Login authentication
Flow	1.Data on AC usage in every lab will be displayed. 2.Recommended switch ons/off and temperature changes will be calculated and displayed. 3.The super user can alter the temperature/ switch off the appropriate AC system.
Post Condition	The user must logout after the session.

Use Case Number	UC-06
Use Case Name	Space user AC Control
Overview	Space User needs to be able to control the AC of his/her labs.
Actors	Space User
Pre-Condition	Login authentication
Flow	1.current temperature and data analytics on recommended temperature will be displayed 2.The space user can alter the temperature/ switch off the lab he or she is in.
Post Condition	The user must logout after the session.

Use Case Number	UC-07
Use Case Name	Graphical Data Analytics
Overview	Graphs of energy consumption, AC temperature versus time are made available to the appropriate users.
Actors	All users
Pre-Condition	Load website/ Launch flask application
Flow	1.User authentication is used to determine the type of data displayed 2.Data is read from the database and converted into graphs using mathworks. 3.Real-time/ Averaged Graphs are displayed via user-friendly UI/UX.
Post Condition	Termination the application after logging out of the session if required.

Use Case Number	UC-08
Use Case Name	Map Analytics
Overview	Maps of temperature and energy consumption in KRB.
Actors	Super User
Pre-Condition	Login Authentication
Flow	1.The data obtained from the Daikin D-BACS is catergorised location wise 2. Maps of temperature and energy consumption across KRB are generated using a mapping tool (TBD) and displayed
Post Condition	User must logout after the session

Use Case Number	UC-09
Use Case Name	Email Alert System
Overview	Email alert is sent to the heads of respective labs when there is overuse of AC system
Actors	Super user
Pre-Condition	Real-time and average data is retrieved from the database
Flow	1. Permissible temperatures/ energy consumption data is obtained 2. Data from the database is compared with the above 3. In case of discrepancies an email alert is sent to the administrator/super user.
Post Condition	The warning trigger is reset.

Use Case Number	UC-10
Use Case Name	Saved Energy
Overview	Calculate and display the energy saved due the alert system implemented by the project
Actors	All Users
Pre-Condition	Data over the span of the entire deployment period must be collected and stored.
Flow	1. The data over the entire project timeframe is analysed and the saved energy per day and on average is calculated 2. Generated graphs and visualisations are displayed
Post Condition	The warning trigger is reset.