Software Requirements Specification

for

Smart Energy Saver

Version 1.0 approved

Prepared by
Chong Zhi Hen
Heng Zeng Xi
Kalaiselvan Sanjeev
Low Jun Keat
Phan Huu An
Tan Zhe Kai

Group 4

10 Sept 2024

Table of Contents

Revision History

Name	Date	Reason For Changes	Version

Use Cases: Navigating Dashboard, Changing Settings, Device management, Cost Estimation

****Access Account" use case <<include>> the "Verify Login Credentials" use case, therefore Access account is the first/base use case as seen below, because Access Account trigger Verify Login Credentials (Only for team explanation purposes)**

******

Difference:

Access Account is initiated post-login.
Register Account is initiated by a new user without existing credentials.
Verify Login Credentials is the process that occurs at the point of login.

Purpose:

- **Access Account is about managing and updating existing account details.**
- **Register Account is about creating a new account and setting up initial access credentials.**
- **Verify Login Credentials serves as a gatekeeper to ensure that only valid users can access their accounts.**

Use Cases Description

Use Case ID:	1		
Use Case Name:	Verify Login Credentials		
Created By:	Heng Zeng Xi	Last Updated By:	Phan Huu An
Date Created:	29/08/2024	Data Last Updated:	06/09/2024

Actor:	User (Initiating), Database
Description:t	This use case verifies the login credentials of a user attempting to access the system. The user enters their username and password, and the system checks if these credentials are stored in the database. If the credentials are valid, the user is granted access to the system. If the credentials are invalid, the user is prompted to re-enter their credentials or initiate a password recovery process.
Preconditions:	The user must have an existing account with valid credentials stored in the system database
Postconditions:	1. The user is successfully authenticated and granted access to the system, proceeding to the main menu 2. The user is not authenticated, and the system displays an error message, prompting the user to try again or reset their password
Priority:	High
Frequency of Use:	1-2 times per day
Flow of Events:	1. User accesses the login page 2. User enters credentials 3. User submits the login form 4. System validates credentials with database 5. If valid, the system grants access and the user proceeds to the main menu. 6. If invalid, the system denies access and prompts for re-entry or password recovery.
Alternative Flows:	AF-S1: User enters incorrect credentials 1. The system detects that the username or password is incorrect 2. The system displays an error message: "Invalid username or password. Please try again." 3. The user is returned to the login page to re-enter their credentials. 4. Return to step 1 a. AF-S2: User leaves required fields empty 1. The system detects that one or more required fields are empty. 2. The system displays an error message: "Username and password fields cannot be empty." 3. The user is prompted to fill in the missing fields and resubmit the form. 4. Return to step 3

	AF-S3: User selects 'Forgot Password' 1. User clicks the "Forgot Password" button. 2. System redirects the user to the password recovery process. 3. Return to the login process after password reset or when the user cancels the recovery process.
Exceptions:	EX-S1: System unable to validate credentials due to connectivity issues 1. The system displays an error message: "Unable to verify credentials at this time. Please try again later." 2. The user is advised to try logging in again after some time or contact support
Includes:	N/A
Special Requirements:	N/A
Assumptions:	N/A
Notes & Issues:	N/A

Use Case ID:	2		
Use Case Name:	Register Account		
Created By:	Heng Zeng Xi	Last Updated By:	Tan Zhe Kai
Date Created:	06/09/2024	Data Last Updated:	06/09/2024

Actor:	User (Initiating), Database
Description:t	This use case describes the process by which a new user creates an account in the system. It includes entering personal information, setting up security details, and verifying email or mobile number.
Preconditions:	1. The user does not have an existing account. 2. The user has access to the registration page.
Postconditions:	1. A new account is created in the database.

	2. The user receives a confirmation email or OTP, requiring verification to activate the account.
Priority:	High
Frequency of Use:	As needed when new users join.
Flow of Events:	1. User navigates to the registration page. 2. User fills in required information, including name, email, and password. 3. User submits the registration form. 4. System checks for duplicate usernames or emails. 5. System sends a verification email or OTP to the user. 6. User verifies their email or enters OTP. 7. System confirms the account creation and directs the user to the login page.
Alternative Flows:	AF-S1: User Decides to Cancel Registration 1. User navigates to the registration page. 2. At any point before submitting the form, the user decides not to continue. 3. User exits the registration page without saving any data. 4. System discards any input data and does not create an account. AF-S2: Email Already in Use 1. User fills out the registration form and enters an email address. 2. System checks the email and finds it is already associated with an existing account. 3. System displays an error message informing the user that the email is in use. 4. System offers options to the user: 5. To redirect to the login page for user authentication. 6. To navigate to the password recovery process if the user has forgotten their password.
Exceptions:	EX-S1: Failure to send verification email/SMS 1. The system displays an error message: "Unable to verify credentials at this time. Please try again later." 2. The user is advised to check their email address or try again later.
Includes:	N/A
Special Requirements:	N/A

Assumptions:	N/A
Notes & Issues:	N/A

Use Case ID:	3		
Use Case Name:	Navigating Dashboard		
Created By:	Heng Zeng Xi	Last Updated By:	Chong Zhi Hen
Date Created:	04/09/2024	Data Last Updated:	05/09/2024

Actor:	Users
Description:	This use case begins once the user is logged into the application. It allows the user to navigate through various features of the dashboard, such as viewing electricity usage, tracking monthly bills, and monitoring individual appliances.
Preconditions:	Users must be logged in and authenticated.
Postconditions:	Users can access different functionalities from the dashboard related to energy management.
Priority:	High
Frequency of Use:	Multiple use per week
Flow of Events:	1. User logs in and is directed to the dashboard 2. User views general electricity usage of all connected appliances. 3. User views the individual appliance's electricity usage details. 4. User track and view monthly electricity bills. 5. User navigates to device management 6. User navigates to other sections or logs out.
Alternative Flows:	AF-S1: User attempts to access a non-responsive feature. 1. User selects a feature from the dashboard. 2. System fails to load the selected feature due to a network or server error.

	3. System displays an error message and prompts the user to retry or return to the main dashboard. 4. User retries or returns to the main dashboard. 5. Return to step 1. AF-S2: User changes mind about viewing details. 1. User is in a specific section accessed from the dashboard. 2. User decides not to make any changes or entries and wishes to return to the main dashboard. 3. User selects the option to return to the main dashboard without making any changes. 4. System navigates the user back to the main dashboard. 5. Return to step 1.
Exceptions:	EX-S1: User not logged in 1. The system detects that no user is currently logged in and displays an error message: "You are not logged in. Please log in to continue accessing the dashboard." 2. The system prompts the user to log in by redirecting them to the login page
Includes:	Verify Login Credentials, Changing of settings
Special Requirements:	N/A
Assumptions:	Users are able to log in.
Notes & Issues:	N/A

Use Case ID:	4		
Use Case Name:	Changing Personal Information		
Created By:	Heng Zeng Xi	Last Updated By:	Phan Huu An
Date Created:	29/08/2024	Data Last Updated:	06/09/2024

Actor:	User (Initiating)
Description:	This use case begins when the user successfully logs into the application and loaded into the Dashboard page. It specifically covers the functionalities that allow users to manage and interact with their account settings and update personal information
Preconditions:	Users must be logged in and authenticated.
Postconditions:	Users can update personal details, change passwords, and set security preferences.
Priority:	High
Frequency of Use:	1 to 2 times
Flow of Events:	1. User navigates to the account settings in the dashboard after successful login. 2. Users update personal details such as name, address, or contact information. 3. User changes the account password. 4. User adjusts security settings or preferences.(2FA) 5. User saves changes and logs out or continues using the app.
Alternative Flows:	AF-S2: User decides not to update personal details 1. User navigates to update personal details but decides not to make any changes. 2. User selects the option to go back or exit without saving. 3. System does not make any changes and returns the user to the main account settings menu. 4. Return to step 1. AF-S3: User decides against changing the password 1. User selects the change password option but decides not to proceed. 2. User chooses to cancel or go back. 3. System cancels the password change process and retains the current password. 4. Return to step 1. AF-S5: User navigates away before saving changes 1. While making changes in any account settings, the user navigates away from the page without saving. 2. System prompts the user to save or discard changes before exiting.

	3. If the user chooses to discard, the system does not save changes and returns the user to the previous menu. 4. If the user chooses to save, the system applies changes and then returns to the previous menu. 5. Return to step 1.
Exceptions:	EX-S1: User not logged into their account 1. The system prompts the user to log in by redirecting them to the login page
Includes:	Verify Login Credentials
Special Requirements:	N/A
Assumptions:	User is able to log in
Notes & Issues:	N/A

Use Case ID:	5		
Use Case Name:	Manage Notification		
Created By:	Heng Zeng Xi	Last Updated By:	
Date Created:	04/09/2024	Data Last Updated:	

Actor:	User and System
Description:	This use case allows the user to customise notification settings within the app, deciding which events they receive notifications for, and how (e.g., via email, push notifications).
Preconditions:	1. The user must be logged into their account. 2. The user must have access to the notifications settings page.
Postconditions:	1. The user's notification settings are updated in the system. 2. The system starts sending notifications based on the new settings.
Priority:	Medium

Frequency of Use:	1-2 times per month
Flow of Events:	1. User logs in and accesses the settings menu. 2. User navigates to the notification settings section in the dashboard. 3. User selects or deselects the types of notifications they wish to receive and chooses the delivery method (e.g., email, mobile push). 4. User saves changes. The system confirms the update. 5. System applies the new settings immediately and schedules notifications as per the user's preferences.
Alternative Flows:	AF-S1: User abandons changes 1. User navigates to notification settings, makes changes, but decides to leave the page without saving. 2. System prompts the user to save or discard changes. If discarded, no changes are applied. 3. Return to step 2 AF-S2: System fails to save settings 1. System detects a technical error while trying to save the user's notification settings. 2. The system informs the user of the error and suggests trying again later 3. Users are given options to 'Retry' or 'Cancel'. 4. If the user chooses 'Retry', the system attempts to save again. 5. If the user chooses 'Cancel', or if the 'Retry' fails repeatedly, user will return to step 2
Exceptions:	EX-S1: System outage or connectivity issues 1. If the system cannot access the database to update settings or if there is a service disruption, the user is informed of the inability to process changes at this time.
Includes:	Verify Login Credentials
Special Requirements:	Security Considerations: 1. Any changes to notification settings should be securely transmitted and stored to prevent unauthorised access or leaks of user preferences.
Assumptions:	Stable Internet Connection: 1. Assumes that users have a stable internet connection to access and modify notification settings without interruptions.

Notes & Issues:	N/A

Use Case ID:	6		
Use Case Name:	Device Management		
Created By:	Heng Zeng Xi	Last Updated By:	Chong Zhi Hen
Date Created:	04/09/2024	Data Last Updated:	05/09/2024

Actor:	User
Description:	This use case is for users to manage their devices. Users will be able to see which appliances they have added, average power consumption and duration of use.
Preconditions:	1. User has logged in and pressed on manage my devices
Postconditions:	1. User can see, edit, add and remove the devices
Priority:	Medium
Frequency of Use:	1-2 times per month
Flow of Events:	1. User press on manage my devices 2. They are able to view the list of devices, along with the power usage and duration 3. They can see more of list by scrolling up and down 4. They can press save to exit device management menu
Alternative Flows:	AF-S1: User want to edit a device power usage 1. User press on manage my devices 2. They are able to view the list of devices, along with the power usage and duration 3. They can see more of list by scrolling up and down 4. When they want to edit the power usage of a device, they press on

	it and can change the value using the onscreen number pad 5. When they are okay with it they can press done on the number pad to remove the number pad 6. They can press save to exit device management menu AF-S2: User want to edit a device usage duration 1. User press on manage my devices 2. They are able to view the list of devices, along with the power usage and duration 3. They can see more of list by scrolling up and down 4. When they want to edit the usage duration of a device, a list of pre selected duration will drop down for user to select 5. When they find the value closest to desired value, they can press on the number and it will remove the drop down and changing to the new value 6. They can press save to exit device management menu
Exceptions:	EX-S1: Missing value 1. If the user tries to press save when there is missing value it will warn the user and stop the user from saving.
Includes:	Adding New Device, Electrical Consumption Calculation
Special Requirements:	Default power usage value 1. There should be a button for user to return a device power usage to the default value
Assumptions:	The devices all draw power from the power grid.
Notes & Issues:	N/A

Use Case ID:	7		
Use Case Name:	Adding New Device		
Created By:	Zhi Hen	Last Updated By:	Heng Zeng Xi
Date Created:	30/8/2024	Data Last Updated:	06/09/2024

Actor:	User, Database
Description:	This use case is for users to add a new device. This allows a new device to be added to the list of user devices
Preconditions:	User is in the manage devices menu
Postconditions:	The device will be added to the list of devices
Priority:	Medium
Frequency of Use:	Everytime the user need to add a device
Flow of Events:	1. User presses on the + button the manage devices menu 2. A new menu pop out with Device, Power Usage and Duration of use 3. User first press on device and a drop down of common appliances will appear 4. User will press on the device they want to add 5. The drop down will close and the device user has selected will appear 6. The value of Power Usage will change to the default value of the appliance 7. User will then press on the duration of use 8. A drop down of preselected values will appear and user select the value closest to the duration they want 9. The drop down will close. 10. User will press ADD to add the new device
Alternative Flows:	EX-S1: User know the power usage value 1. User presses on the + button the manage devices menu 2. A new menu pop out with Device, Power Usage and Duration of use 3. User first press on device and a drop down of common appliances will appear 4. User will press on the device they want to add 5. The drop down will close and the device user has selected will appear 6. The value of Power Usage will change to the default value of the appliance 7. The User presses the box on power usage and an onscreen number pad will appear to allow them to key in the value. 8. When they are okay with it they can press done on the number pad to remove the number pad 9. User will then press on the duration of use

	10. A drop down of preselected values will appear and user select the value closest to the duration they want 11. The drop down will close. 12. User will press ADD to add the new device EX-S2: User device is not on default devices list 1. User presses on the + button the manage devices menu 2. A new menu pop out with Device, Power Usage and Duration of use 3. User first press on device and a drop down of common appliances will appear 4. User will press on the others 5. The drop down will close and the keyboard will appear 6. User will then key in the device name and presses done 7. The value of Power Usage will be empty 8. The User presses the box on power usage and an onscreen number pad will appear to allow them to key in the value. 9. When they are okay with it they can press done on the number pad to remove the number pad 10. User will then press on the duration of use 11. A drop down of preselected values will appear and user select the value closest to the duration they want 12. The drop down will close. 13. User will press ADD to add the new device
Exceptions:	EX-S1: The power usage entered is too large 1. The system displays an error message that Power usage exceeds the maximum limit of watts. 2. The user is advised to adjust the power usage value to a valid range and attempt to add the device again.
Includes:	Device Management
Special Requirements:	User is already in the manage my device menu
Assumptions:	We have default power consumption value using the database
Notes & Issues:	N/A

Use Case ID:	8		
Use Case Name:	Electrical Consumption Calculation		
Created By:	Zhi Hen	Last Updated By:	Heng Zeng Xi
Date Created:	30/8/2024	Data Last Updated:	06/09/2024

Actor:	User, Database
Description:	Using the parameters the User has provided, the app will calculate and give the user an overview of their energy consumption. They will be able to see an estimate of average energy consumption, which appliances are drawing the most electricity, the estimated electricity bill and more.
Preconditions:	User must have keyed in all of the required parameters and is on the device management menu
Postconditions:	The calculation is saved and displayed on dashboard
Priority:	Medium
Frequency of Use:	Everytime calculation is required
Flow of Events:	1. Users navigate to the device management menu to review and adjust device parameters. 2. Press "Save" to start the energy consumption calculation. 3. System calculates total energy usage based on updated device parameters. 4. Upon calculation completion, the dashboard refreshes to display new values and graphs showing energy distribution. 5. Receive a confirmation notification and automatically return to the main dashboard.
Alternative Flows:	AF-S1: User modifies parameters before final calculation 1. User navigates to the device management menu. 2. User adjusts one or more parameters related to the devices 3. User presses "Calculate" to see the immediate impact of the changes on the estimated energy consumption. 4. The system recalculates the values based on the new inputs. 5. The dashboard updates to reflect the new calculation results. 6. If satisfied, the user presses "Save" to finalise the changes, or continues to adjust parameters if further refinement is needed.

	7. Return to step 1
Exceptions:	EX-S1: System unable to calculate due to missing data 1. User presses "Calculate" but has not completed all necessary input fields. 2. The system checks for completeness and finds missing data. 3. An error message is displayed, instructing the user to enter all required information. 4. User returns to the input fields to complete the missing data and then reinitiates the calculation. EX-S2: System error during calculation process 1. User presses "Calculate" after entering all required data. 2. A system error occurs during the calculation, unrelated to user input (e.g., server error, timeout). 3. The system displays a generic error message suggesting the user to try again later. 4. Users may attempt to recalculate immediately or return to the dashboard to try again at a later time.
Includes:	Device Management
Special Requirements:	N/A
Assumptions:	The power usage is calculated based on average consumption and does not account for when devices draw more power under load.
Notes & Issues:	N/A

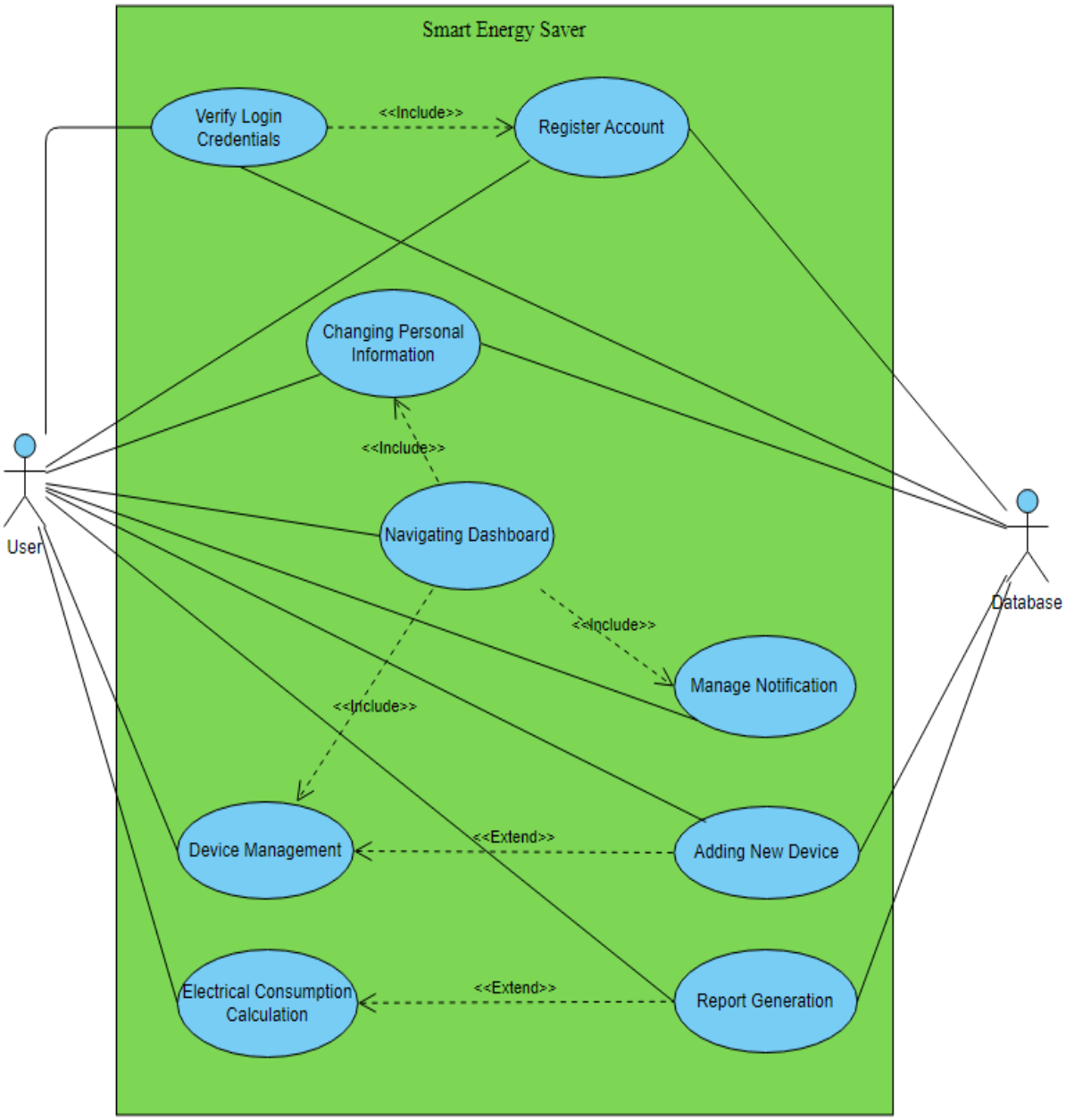
Use Case ID:	9		
Use Case Name:	Report Generation		
Created By:	Zhi Hen	Last Updated By:	Heng Zeng Xi
Date Created:	05/09/2024	Data Last Updated:	06/09/2024

Actor:	User

Description:	This use case allows the user to generate and view reports based on their historical energy consumption. Reports can include detailed usage statistics, comparisons with previous periods, and graphical representations of data to aid in understanding consumption trends.
Preconditions:	1. User has logged into with their account 2. Historical data on energy consumption is available.
Postconditions:	1. User will be able to change settingsA report based on the selected parameters is generated and displayed to the user 2. The user can export the report to external formats such as PDF
Priority:	Medium
Frequency of Use:	Monthly or as needed
Flow of Events:	1. User navigates to the "Reports" section via the main dashboard or menu. 2. Users select the type of report they wish to generate (e.g., daily, monthly, yearly consumption). 3. User selects additional parameters such as time frame, type of data visualisation (chart, graph, table), and comparison metrics. 4. The system processes the request and generates the report based on the specified parameters. 5. The report is displayed to the user with options to download or export. 6. Users can choose to generate another report or return to the dashboard.
Alternative Flows:	AF-S1: User wants to regenerate a previously generated report 1. User navigates to the "Reports" section. 2. Users access the "History" tab where previously generated reports are listed. 3. User selects a report from the list and chooses the option to regenerate. 4. The system fetches the data for the same parameters as the original report and displays the updated report. 5. Users can then download or share the regenerated report. AF-S2: User modifies the data visualisation type User selects to generate a report as usual by setting the desired parameters. Before finalising, the user selects the option to change the visualisation type (e.g., from bar chart to line graph). The system updates the report preview with the new visualisation.

	User reviews the updated visualisation and proceeds to generate the full report with the chosen settings.
Exceptions:	EX-S1: No data available for the selected period 1. User selects a date range for the report and proceeds to generate it. 2. The system attempts to fetch data for the specified period but finds no records. 3. The system displays an error message indicating no data is available for the chosen period. 4. Users are prompted to select a different date range or to try again later. EX-S2: System error during report generation 1. User sets the parameters for the report and initiates the generation process. 2. A system error occurs, preventing the report from being generated. 3. The system displays an error message detailing the issue and possibly suggesting steps to resolve it or try again. 4. Users may attempt to regenerate the report or contact support if the issue persists.
Includes:	Navigating Dashboard
Special Requirements:	N/A
Assumptions:	N/A
Notes & Issues:	N/A

Use Case Diagram



1. Introduction

1.1 Purpose

This document specifies the software requirements for the mobile application Smart Energy Saver as part of the Smart Nation movement.

Smart Energy Saver is a mobile application designed to help users monitor and reduce their household energy consumption. It provides insights and recommendations based on Singapore's historical energy usage to obtain the average household energy consumption. This allows users to compare their energy usage with similar household types. The app also enables users to set goals for reducing their carbon footprint and alerts for high energy usage. Budgeting controls allow users to set a threshold to meet their financial needs.

1.2 Document Conventions

Prioritisation of Requirments: The priority of higher-level requirements is assumed to be inherited by detailed requirements unless explicitly stated otherwise.

Main Header: Font Family: Times New Roman, Font Size: 18, Font Weight: Bold
Subsection Header: Font Family: Times New Roman, Font Size: 14, Font Weight: Bold
Content: Font Family: Times New Roman, Font Size: 11
Tables & Figures: Font Family: Times New Roman, Font Size: 11

1.3 Intended Audience and Reading Suggestions

This document is intended for users of the app, the software developers of the app, documentation writers, marketing staff, project managers and testers and all other potential business partners.

The document contains a description of each function in the app. For each function, a use case is presented for readers to understand the sequence of each process. The next section entails the requirements for the external interface such as the hardware and software interfaces. The functional requirements for each feature are stated and the non-functional requirements are located at the end of the document.

For users, documentation writers, marketing staff and business partners, there is no recommended sequence for reading the document. As for the software developers and project managers, the recommended sequence would be the overall description first, followed by each system function, and then the specific requirements, which include the external interface and non-functional requirements.

1.4 Product Scope

Smart Energy Saver is a mobile application that aims to promote the adoption of energy-saving habits by offering personalised tips for reducing energy consumption, such as using a fan instead of an air conditioner or switching to the eco-mode function available in the appliance. The potential benefits of the app are lower energy bills, enhanced appliance lifespan, and environmental protection.

Objectives:

- To provide users with a tool to compute their monthly energy consumption.
- To reduce users' carbon footprint.
- To provide personalised energy-saving tips for users based on their energy consumption.
- To offer detailed reports and visualisations for users to understand their energy consumption.

Benefits:

- **Cost Reduction:** Users can significantly lower their utility bills based on their projected monthly energy consumption.
- **Environmental Impact:** Users are encouraged to adopt eco-friendly practices by reducing their carbon footprint and aligning with sustainability goals.
- **Better Decision Making:** Users are provided with data and recommendations for ease of making energy-saving decisions.
- **Convenience**: Users can integrate the app with smart home devices and interact with them on the go.

1.5 References

1. GitHub Repository - github.com/softwarelab3/2006-TDDB-48
2. Android -
3. Energy Market Authority of Singapore (EMA) - ema.gov.sg
4. Singapore's Open Data Platform - data.gov.sg
5. SP Group - spgroup.com.sg

2. Overall Description

2.1 Product Perspective

The product being specified in this Software Requirements Specification (SRS) is a new, self-contained mobile application designed to assist users in monitoring and managing their household electricity consumption. This application does not follow on from any existing product family but is instead developed as a standalone solution tailored to meet the growing demand for energy efficiency and cost savings in the home.

2.2 Product Functions

1. User Account Management

Access Account:

1. Allow users to log into their accounts.
2. Enable access to personalised data.
3. Interact with various functionalities, such as viewing electricity usage, tracking bills, adding/removing appliances, and logging out.

Verify Login Credentials:

1. Authenticate user login attempts using stored credentials.
2. Handle scenarios like incorrect credentials, empty fields, and password recovery.

2. Electricity Usage Monitoring

View General Electricity Usage:
1. Display the overall electricity usage for all appliances.

View Individual Appliance Usage:
1. Provide detailed electricity consumption data for each appliance.

Track Monthly Electricity Bills:
1. Allow users to monitor and track their monthly electricity costs.

3. Appliance Management

Entering Appliances Information:
1. Enable users to input information about their appliances, including average usage duration and power consumption.
2. Assist users in selecting appliances and setting their usage parameters.

Add/Remove Appliances:
1. Provide functionality to add new appliances to the monitoring list or remove existing ones.
2. Manage scenarios where users choose to cancel actions related to appliance management.

4. Electricity Consumption Calculation

Calculate Electrical Consumption:
1. Compute and provide an overview of the user's energy consumption based on the inputted appliance information.

Display Detailed Consumption Reports:
1. Allow users to view detailed breakdowns of their energy consumption.
2. Identify which appliances are using the most electricity.

Handle Calculation Errors:
1. Notify users of any errors encountered during the calculation and guide them on how to correct these errors.

5. Error Handling and User Assistance

Handle Incorrect Credentials:
1. Display appropriate error messages and prompts when users enter incorrect login credentials.

Assist with Appliance Entry Errors:
1. Provide guidance and prompts if the user is unable to find or enter the correct appliance information.

Notify of Calculation Errors:
1. Alert users to any errors encountered during the calculation of energy consumption and guide them on how to correct these errors.

2.3 User Classes and Characteristics

1. <u>Regular Users</u>

Frequency of Use: Moderate (1-2 times per day)

Subset of Product Functions Used:
1. Access Account
2. View electricity usage (general and individual appliances)
3. Track monthly electricity bills
4. Enter appliance information
5. Calculate electrical consumption

Technical Expertise: Basic to Moderate

Security or Privilege Levels: Basic User Privileges (Authenticated user access)

Educational Level/Experience: General homeowners with basic knowledge of using mobile apps and understanding of household appliances.

Pertinent Characteristics:
1. Regular users will most frequently interact with the app to monitor and manage their electricity usage.
2. They are the primary target audience and require a user-friendly interface with clear instructions.

Importance: High

Comments: This is the most important user class, as the product is designed primarily for them. The app must meet their needs for ease of use, reliability, and clear information presentation.

<u>2.Technical Support Users</u>

Frequency of Use: Low (Occasional)

Subset of Product Functions Used:
1. Verify Login Credentials
2. Troubleshoot issues related to login, data entry, and calculation errors.

Technical Expertise: High

Security or Privilege Levels: Elevated Privileges (Administrative access for troubleshooting)

Educational Level/Experience: Technical background, likely with experience in IT support or system administration.

Pertinent Characteristics:
1. This user class is responsible for addressing technical issues that regular users might face.
2. They require access to error logs, system diagnostics, and possibly the ability to reset or override user credentials.

Importance: Medium

Comments: While not as frequently engaged with the product as regular users, technical support users are crucial for maintaining the product's reliability and ensuring a smooth user experience.

3. Power Users

Frequency of Use: High (Daily)

Subset of Product Functions Used:

1. All functions, with a focus on detailed analysis and tracking.
2. Likely to engage more with advanced features like detailed breakdowns of energy consumption and historical data comparisons.

Technical Expertise: Moderate to High

Security or Privilege Levels: Standard User Privileges, but with more frequent and intensive usage patterns.

Educational Level/Experience: Likely more tech-savvy with a higher interest in energy management and efficiency.

Pertinent Characteristics:

1. Power users demand more from the app in terms of performance, data accuracy, and the availability of advanced features.
2. They may push the app's capabilities further and are likely to provide feedback on advanced functionality.

Importance: Medium

Comments: While not the primary target, satisfying this user class can lead to positive word-of-mouth and detailed user feedback that could drive future enhancements.

4. Infrequent Users

Frequency of Use: Low (Occasional)

Subset of Product Functions Used:

1. Mainly Access Account and possibly occasional checks on electricity usage and bills.

Technical Expertise: Low

Security or Privilege Levels: Basic User Privileges

Educational Level/Experience: General users who may not be very tech-savvy.

Pertinent Characteristics:

1. This group uses the app sporadically and may need reminders or prompts to engage with certain features.
2. The user interface must be intuitive enough to ensure that even infrequent users can easily navigate the app without needing a refresher each time.

Importance: Low

Comments: While important to consider, this user class is less critical compared to regular users and power users. However, their needs should still be met to ensure overall satisfaction.

Summary of Importance:
1. **Most Important User Class:** Regular Users
2. **Moderately Important User Classes:** Technical Support Users, Power Users
3. **Less Important User Class:** Infrequent Users

This categorization ensures that the product is designed and optimised primarily for those who will use it most frequently, while still addressing the needs of other user classes.

2.4 Operating Environment

1.Hardware Platform

1. The app will be designed to run on mobile devices, including both smartphones and tablets.
2. Supported Devices:
    - Apple Devices: iPhones and iPads.
    - Android Devices: A wide range of Android smartphones and tablets from various manufacturers.

2. Operating System and Versions

Apple iOS:

1. The app will support devices running **iOS 14** and later versions.
2. The development and testing will ensure compatibility with the latest iOS versions, including those with varying screen sizes and hardware capabilities.

Android OS:

1. The app will support devices running Android 9.0 (Pie) and later versions.
2. Consideration will be given to the diverse range of Android devices, ensuring compatibility across different manufacturers, screen sizes, and device specifications.

3. Software Components and Dependencies

Cross-Platform Development Framework:

1. The app may utilize a cross-platform framework such as React Native or Flutter to enable simultaneous development for both iOS and Android.

API Integration:

1. The app will integrate with backend APIs to manage user accounts, retrieve electricity usage data, and perform calculations. These APIs must be compatible with both iOS and Android environments.

Database and Cloud Services:

1. The app will interact with cloud-based services for data storage, ensuring data is securely stored and accessible across both platforms.

Security and Compliance:

1. The app will comply with the security requirements of both the Apple App Store and Google Play Store, including data encryption, user privacy, and secure login mechanisms.

User Interface Consistency:

1. While the app will maintain a consistent user experience across both platforms, it will adhere to the design guidelines of Apple's Human Interface Guidelines (HIG)and Google's Material Design to ensure a native feel on each platform.

4. Coexistence with Other Applications

1. The app must peacefully coexist with other apps on the user's device, particularly those that might also access data related to electricity usage or home automation.
2. It should not interfere with the operation of other apps and should efficiently manage its resources (e.g., battery consumption, memory usage) to avoid negatively impacting the device's overall performance.

The app will be built to operate smoothly on both Apple and Android devices, covering a broad range of OS versions and ensuring compatibility with other software and hardware components on these devices. The development process will include thorough testing across different environments to ensure a consistent and reliable user experience.

This approach ensures that your app will meet the requirements for a seamless operation in the diverse mobile environment of your target users.

3. System Features

3.1 Login

1. The system allows users to login to their account using the email address and password
   - 1.1. The system must check if the information is correct by accessing the database
     - 1.1.1. If they are correct, the system displays the dashboard for their account
     - 1.1.2. If they are not, the user may choose to recover the password by hitting the 'Forgot Password' button.

3.2 Registration

1. The user must be able to register a new account in the system.
   - 1.1. The system must display 3 required text fields and 1 optional text field for the user to enter registration information.
     - 1.1.1. The system must include a text field for Username (required).
     - 1.1.2. The system must include a text field for Email Address (required).
     - 1.1.3. The system must include a text field for the Mobile Number (optional).
     - 1.1.4. The system must include a text field for Password (required).

1.2. The user must enter all the required fields before clicking the 'Register' button.
  1.2.1. The system must display an alert message if any required fields are empty.
1.3. The system must verify the fields entered by the user.
  1.3.1. The system must check that the username is unique and does not exist in the database.
  1.3.2. The system must check that the email is in the correct format.
  1.3.3. The system must check that the email does not exist in the database.
  1.3.4. The system must check that the mobile number is in the correct format.
  1.3.5. The system must check that the password has met the password requirements.
    1.3.5.1. The password must be at least 8 characters in length.
    1.3.5.2. The password must contain at least 1 uppercase letter and 1 lowercase letter.
    1.3.5.3. The password must be alphanumeric.
  1.3.6. The system must display an alert message for any fields that fail to meet the requirements.
1.4. The system must allow the user to request verification by receiving a verification email or an OTP.
  1.4.1. The system must send a verification email to the user's email address.
  1.4.2. The system must send an OTP to the user's mobile number.
  1.4.3. The system must display an error message for failure to send a verification email or OTP.
1.5. The system must create an account upon verification.
  1.5.1. The system must store the user's account information in the database.
  1.5.2. The system must display a message upon a successful or unsuccessful account creation.

3.3 Dashboard

1. The user must allow users to change their details and settings by hitting "Account Setting" button on the Side Menu
  1.1. The personal detail include:
    1.1.1. Name
    1.1.2. Physcial Address
    1.1.3. Contact Infomation(email and phone number)
    1.1.4. Account Password
  1.2. The settings include:
    1.2.1. Security setting
  1.3. The system save the changes:
    1.3.1. The system save the personal details to the database
    1.3.2. The system change the security according:
      1.3.2.1. If user choose to user 2FA,the system will sent the verification code to email each time his/her account is logged in.
        1.3.2.1.1. The user have to confirm his/her use of account
        1.3.2.1.2. Fail to do so, the account will be logged out.

3.4 Account Management

1. The system must allow users to view and edit their account information (e.g. name, email, mobile number)
    1.1. The system must include an 'Edit' button for users to edit account information.
    1.2. The system must include input fields for entering the new account information.
2. The system must allow users to change or reset their password.
    2.1. The system must provide 3 input fields for entering the 'Current Password', the 'New Password' and 'Confirm New Password'.
    2.2. The system must validate that the password has met the minimum password requirements.
        2.2.1. The password must be alphanumeric, at least 8 characters long, and contain at least 1 uppercase character and 1 lowercase character.
    2.3. The system must validate that the 'New Password' is not exactly the 'Old Password'.
3. The system must allow users to change their security settings.
    3.1. The system must provide 2 options for 2FA (e.g. OTP or verification email).
4. The system must allow users to deactivate their account.
    4.1. The system must send a confirmation email before processing the account deletion.
5. The system must verify that the user is logged in to access account information.

3.5 Notifications Management

1. The system allow user to change notification settings by hitting "Notification Setting" in the Side Menu.
    1.1. The setting include:
        1.1.1. The method of sending (email,mobile push)
        1.1.2. Scheduling
    1.2. The system will schedule notification and use the correct method accordingly.

3.6 Device Management

1. The system allow users to see a short power usage description in "Power Usage" tab
    1.1. The system show the exact power usage from the beginning of the month to current day:
        1.1.1. The format for the power uasge is kWh
    1.2. The system show comparison of users' power usage with national average power usage
    1.3. The system show information of 3 highest usage devices by expanding "Power Tab":

1.3.1. The information include:
1.3.1.1. Name of the device
1.3.1.2. Power Usage(in kWh)
1.3.1.3. Partition of usage in total usage (in %)

2. The system allow users to access their appliance list in My Device by hitting “Manage my device” in the expanded “Power Usage” tab
2.1. The system allow user to see the consumption data of each appliance:
2.1.1. The data include:
2.1.1.1. Name of the device
2.1.1.2. Average Power Usage (in kW)
2.1.1.3. Duration (in Hour/Day)
2.2. The system allow user to edit the consumption data of each appliance:
2.2.1. The data include:
2.2.1.1. Average Power Usage
2.2.1.2. Duration
2.2.2. The system will save the detail accordingly to the database.
2.3. The system allow user to remove an appliance by hitting “X” button under the name of the appliance.

3.7 Adding New Device

1. The system must allow user to ADD new appliance to the appliance list by hitting “+” in My Device
1.1. The user must select the name of device
1.2. The user must fill in the average power of the appliance:
1.2.1. In case user do not fill in, the system will use default value.
1.3. The user must fill in the usage of the appliance
1.4. After all previous condition have been filled, the system will add the appliance to account’s appliance list.

3.8 Electricity Consumption Calculator

1. The system must calculate the total electricity consumption based on the devices in the device manager.
1.1. The system must validate that all required fields are entered in the device management menu before calculation.
1.1.1. The system must display an error message if there are missing fields.
1.2. The system must provide a ‘Calculate’ button to perform calculations.
1.3. The system must perform calculations using the correct algorithm and formula.
2. The system must calculate the expected cost for the total electricity consumption.
2.1. The system must use the latest electricity tariffs for calculations.
2.2. The system must calculate the total cost of electricity usage for each device.
2.3. The system must determine the devices with the most electrical consumption.
2.4. The system must calculate the total electricity bill for the specified period.

3. The system must display the average monthly household electricity consumption.
   3.1. The values must be retrieved from the EMA dataset.
   3.2. The system is not required to perform calculations for this metric.
4. The system must display a confirmation notification for updated calculation changes.

3.9 Generating Report

1. The system must allow user to generate a report of their total electricity consumption.
   1.1. The layout of the report must be consistent across all users.
   1.2. The report must state the electricity consumption per appliance.
   1.3. The system must display an error message if the system fails to generate the report.
2. The system must allow the user to select the period range to generate the report (e.g. daily, monthly, annually).
   2.1. The system must retrieve historical data on electricity consumption.
   2.2. The system must provide the report statistics in chronological order.
   2.3. The system must display an error message if there is no data available in the chosen period.
3. The system must display a graphical representation of the data.
   3.1. The system must allow the user to select the type of data visualization (e.g. chart, graph, table).
   3.2. The system must provide a preview of the visualization.
4. The system must be logged into his account to generate or view report.
5. The system must allow users to download the report into different file formats.
   5.1. The recommended file format is PDF.
   5.2. The system must provide a ‘Download’ button for the user to download the report.
   5.3. The system must display a message for successful download of the report.
6. The system must store the record of the report generated.
   6.1. The system must allow users to access previously generated reports in ‘History’.

4. Other Nonfunctional Requirements

4.1 Performance Requirements

1. The system must be able to run with little downtime and no crash.
2. The system must return result for any interaction within 3 seconds.

4.2 Usability Requirements

1. 90% of the users must be able to generate a report of their total electricity consumption within 30 seconds.
2. The notification messages must be clear, precise and helpful for user clarity.

4.3 Security Requirements

1. Each account cannot access, or manipulate the private data of another account.
    1.1. Private data include:
        1.1.1. Monitor list
        1.1.2. Bill
2. The system must adopt two-factor authentication during user registration and user login.
3. The system must mask the password field to preserve user privacy.
4. The account password for each user stored in the database must be encrypted.

4.4 Reliability Requirements

1. The recommendations for reducing electrical consumption must be sound and accurate.
2. The estimated total cost and total electrical consumption must have at least 95% accuracy.
3. During application downtime, it must not interfere with user processes and allow users to continue to perform application functions.

4.5 Business Rules

1. The system must store the information in a database for scalability
    1.1. The information include:
        1.1.1. Private data of each account
        1.1.2. Average power usage of each device
        1.1.3. Electrical Price
2. The system must maintain the data integrity

5. Other Requirements

5.1 Data Dictionary

Term	Definition
System	The system is the Smart Energy Saver application
User	A user is a person who is using the application to optimize the electricity use in his/her household.
OTP	A one-time password (*OTP*) is commonly used for two-factor authentication for user verification purposes. OTP is a form of two-factor authentication (2FA). For this project, the format of

	OTP will be 4-digits.
2FA	Two-factor authentication (2FA) is a security feature that requires two forms of identification to verify the user before accessing the system.
Side Menu	Side menu is the set of links that can be accessed by clicking "☰" button on the left hand side
Notification	Notification in the app is an alert that update information about total power usage.
Appliance	An appliance is a household device that consumes electricity.
Usage	The usage of an appliance is the duration of use of it.
Consumption data	Consumption data of an appliance is data of usage of it including the name, average power, and duration.
Appliance List	Appliance list is the list of the appliance together with the consumption data.
Bill	Bill is the estimated amount of electrical money for the current month based on the current amount of electrical usage.