**Requirements Specification**

Intelligent Home Energy Monitoring System

## *Overview*

The Intelligent Home Energy Monitoring System is a web-based application designed to help homeowners monitor, understand, and manage electricity usage within their homes. The system focuses on simplicity, usability, and meaningful insights rather than technical complexity. This requirements specification outlines the functional and non-functional requirements necessary to meet the project goals and user needs.

## *Functional Requirements*

### User Authentication and Account Management

- The system shall allow users to create an account using a signup form.
- The system shall allow registered users to log in securely.
- The system shall allow users to reset their password through the web application.
- The system shall store user profile information securely in a database.
- The system shall allow users to edit their profile information, including uploading a profile picture.

## *Non-Functional Requirements*

### Usability

- The system shall be easy to navigate and understandable for non-technical users.
- The dashboard shall present information in a clean and uncluttered layout.
- High-level energy insights shall be visible without requiring deep interaction.

## *Device Management*

- The system shall allow users to add devices from a predefined list of household outlets (e.g., Kitchen, Living Room, Bedroom, Laundry Room).
- The system shall allow users to assign optional nicknames to devices (e.g., TV, Washer).

- The system shall display all active devices in the Live Devices section of the dashboard.
- The system shall allow users to edit device nicknames.
- The system shall allow users to remove devices from tracking.
- The system shall automatically reflect added or removed devices in all relevant dashboard sections.

*Live Energy Usage Monitoring*

- The system shall display live energy usage values for each active device.
- Live energy usage values shall be simulated for demonstration purposes.
- The system shall update displayed energy usage data without requiring a page refresh.

*Usage Overview and Status Indicators*

- The system shall provide a Usage Overview section on the dashboard.
- The Usage Overview shall display high-level energy status labels for each device, including Eco, Normal, and Over usage.
- Status labels shall be determined based on realistic household energy usage expectations for different outlet types.
- The Usage Overview shall be read-only and automatically reflecting all active devices.

*Historical Energy Data*

- The system shall allow users to view historical energy usage data for individual devices.
- Historical data shall be displayed in a popup window.
- The system shall provide multiple time ranges for historical data viewing, including:
    - Last 24 hours
    - Last 7 days
    - Last month
    - Last year
- Historical energy usage shall be visualized using bar graphs.

*User Interface and Interaction*

- The system shall use modal popups for device management and data viewing.
- The system shall display clear error messages when user actions fail.
- The system shall display loading indicators during data retrieval operations.
- The system shall include clear buttons on input fields to improve usability.
- The system shall include a “Back to Top” button for long dashboard pages.
- The system shall support a welcome tutorial popup for first-time users.

*Performance*

- The system shall respond to user actions within a reasonable time.
- The system shall handle multiple devices per user without noticeable performance degradation.

*Scalability*

- The system shall be designed to support future expansion, such as additional devices or enhanced analytics.
- The backend architecture shall allow for future integration with real smart home hardware.

*Security*

- User authentication data shall be securely stored and managed.
- Access to user data shall be restricted to authenticated users.
- The system shall protect sensitive user information from unauthorized access.

*Maintainability*

- The system shall use a modular frontend and backend structure.
- Code shall be organized to allow future updates without major redesign.

*Future Considerations*

- The system may include a developer-only debug panel to simulate energy usage spikes for demonstration purposes.
- Advanced data visualization and additional smart home features may be added in future versions.