# Smart Home User Manual

# COTENT

# 1. Login & Registration

## 1.1. Page Overview

This page serves as the entry point to the Smart Home System. Users can log into an existing account or register a new one. The system ensures secure access through strict input validation on both client and server sides.

## 1.2. Login Page

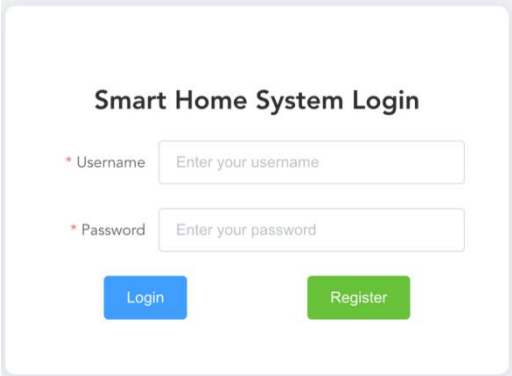



Figure. 1. Login Page

**Functionality**

- Users can access the system with a registered username and password.
- Successful login redirects to the home page.
- An error message is shown if login fails (e.g., incorrect username or password).

**Instructions**

a. Enter your username in the "Username" field.
b. Enter your password in the "Password" field.
c. Click the "Login" button.
d. If the credentials are correct, you will be redirected to the dashboard.

## 1.3. Registration Page

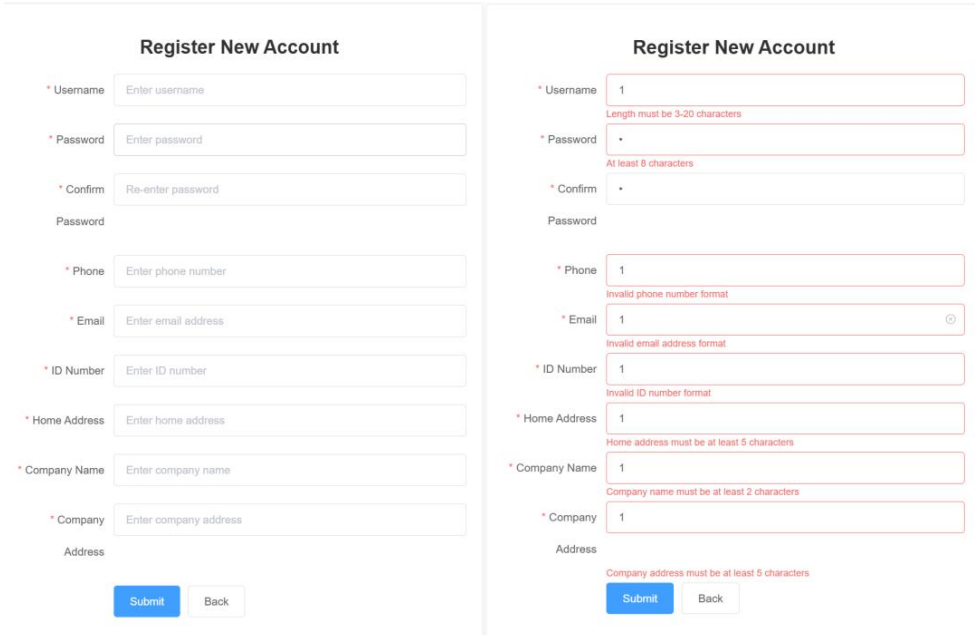



Figure. 2. Registration Page

**Functionality**

- New users must provide detailed personal information to register.
- After registration, users can log in with the new account.

**Instructions**

a. Click the "Register" button to open the registration form.

b. Fill in all required fields:

- Username: 3–20 characters, only letters, numbers, and underscores.
- Password: At least 8 characters, must include uppercase, lowercase, number, and special character.
- Confirm Password: Must match the password.
- Phone: Valid Chinese mobile number.
- Email: Valid email address format.
- ID Number: Valid 15 or 18-digit Chinese ID number.
- Home Address: At least 5 characters.
- Company Name: At least 2 characters.
- Company Address: At least 5 characters.

c. Click the "Submit" button to complete the registration.

d. On success, the form closes, and you can log in.

### 1.4. Input Validation

Each field has built-in validation rules. If a value is incorrect, an error message appears under the field. You must correct all errors before submitting.

### 1.5. Notes and Recommendations

- Keep your login credentials secure. Use a strong password.
- Username, phone number, email, and ID number must be unique.
- Registration will not proceed if input validation fails; the system will display specific

error messages.

## 2. Home Page

### 2.1. Page Overview

This page serves as the main entry point for the Smart Home Management System. It provides a welcome interface, quick access to key features such as real-time monitoring, device control, and data history, and integrates an AI floating assistant to help users interact with the system through conversational queries.

### 2.2. Welcome Part

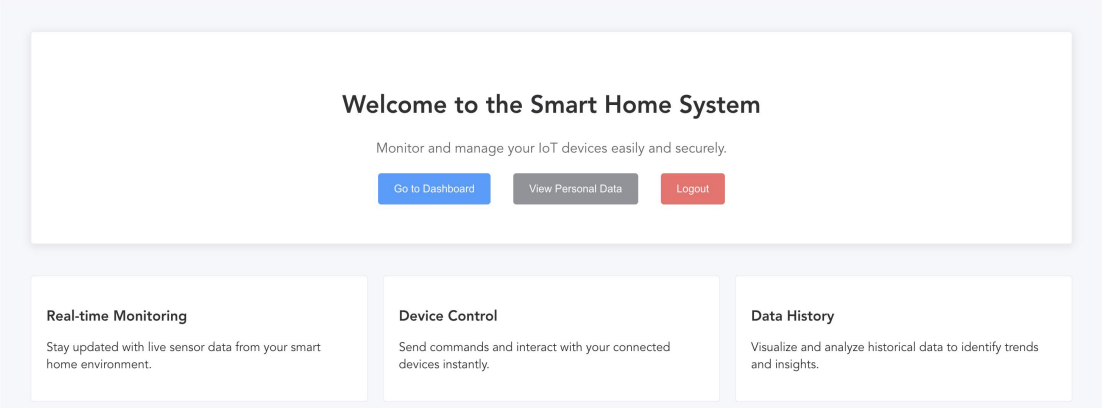



Figure. 3. Welcome Page

**Functionality**

- Displays three quick action buttons allowing users to navigate to essential pages:
- Go to Dashboard: View MQTT real-time monitoring dashboard.
- View Personal Data: Access personal account information and settings.
- Logout: Sign out of the system.

**Instructions**

a. Click Go to Dashboard to view real-time IoT device data.
b. Click View Personal Data to manage personal profile and account settings.
c. Click Logout to safely exit the system.

### 2.3. Feature Cards

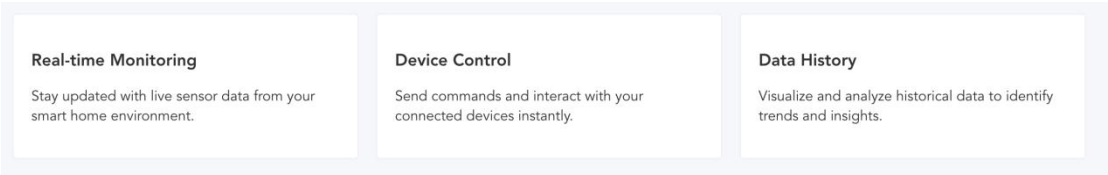



Figure. 4. Feature Cards

**Functionality**

- Showcases three feature cards for direct access to key system modules:
- Real-time Monitoring: View live sensor data and current device status.

- Device Control: Send commands to devices and manage their state.
- Data History: View and analyze historical device data.

**Instructions**

a. Click any of the cards to navigate to the respective functional page.
b. Cards are interactive and provide a brief description of each feature.

### 2.4. AI Floating Assistant

Figure. 5. AI Assistant

**Functionality**

- A round floating AI icon is located at the bottom right corner.
- Clicking the icon opens a chat window for interaction with the Smart Home Assistant.
- The AI assistant can answer system-related questions and provide operational guidance.

**Instructions**

a. Click the AI floating icon to open the chat window.
b. Type your question into the input field.
c. Press Enter or click the Send button to submit your message.
d. The AI assistant will respond through the chat panel.

**Initial AI Greeting**

- Upon first page loading, the system sends an automatic message to the AI assistant.
- The AI replies with a greeting and introduction to its capabilities.

### 2.5. Notes and Tips

- Ensure network connectivity for AI assistant functionality.
- All API requests require a valid API Key and correct endpoint URL.
- AI replies are generated using an external API service (Ark AI Assistant).

### 2.6. Important

- The username is displayed on the personal data page and cannot be changed.
- AI floating assistant functionality requires valid API authorization.
- Real-time data viewing and control features depend on active MQTT broker connection.

## 3. MQTT Connection & Subscription Page

### 3.1. Page Overview

This page allows users to connect to an MQTT broker, subscribe to device topics, and

retrieve real-time messages published by the smart home system. It serves as a connection and monitoring interface between the frontend and the backend.

### 3.2. MQTT Connection

### 3.3. Subscription Theme

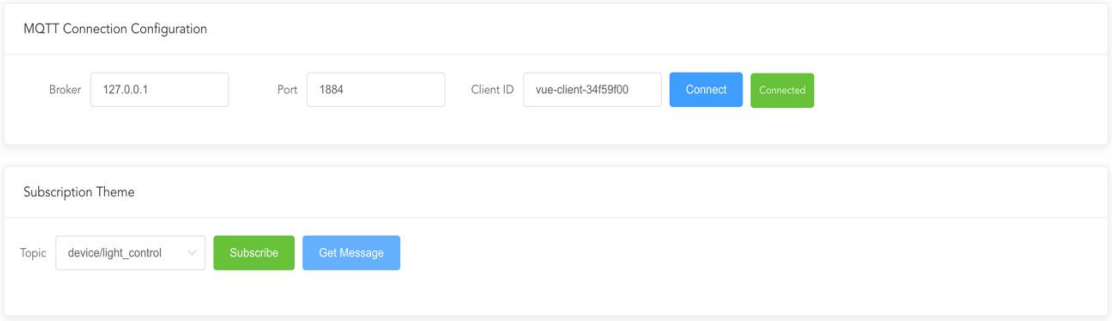



Figure. 7. Subscrition Theme

**Functionality**

Users can select and subscribe to a device topic. Upon subscription, the system redirects to the device's detail page to start receiving data.

**Instructions**

a. Choose a topic from the drop-down list (e.g., device/light_control).
b. Click the Subscribe button.
c. The system will automatically navigate to the detail page for that device.
d. Wait for data to load on the detail page, then click the Back button to return.

**Important**

Before using the Get Message button, you must first subscribe to a topic and visit its corresponding detail page. This step ensures that the system receives and stores the first set of MQTT messages. Otherwise, Get Message may return no results.

### 3.4. Received Messages

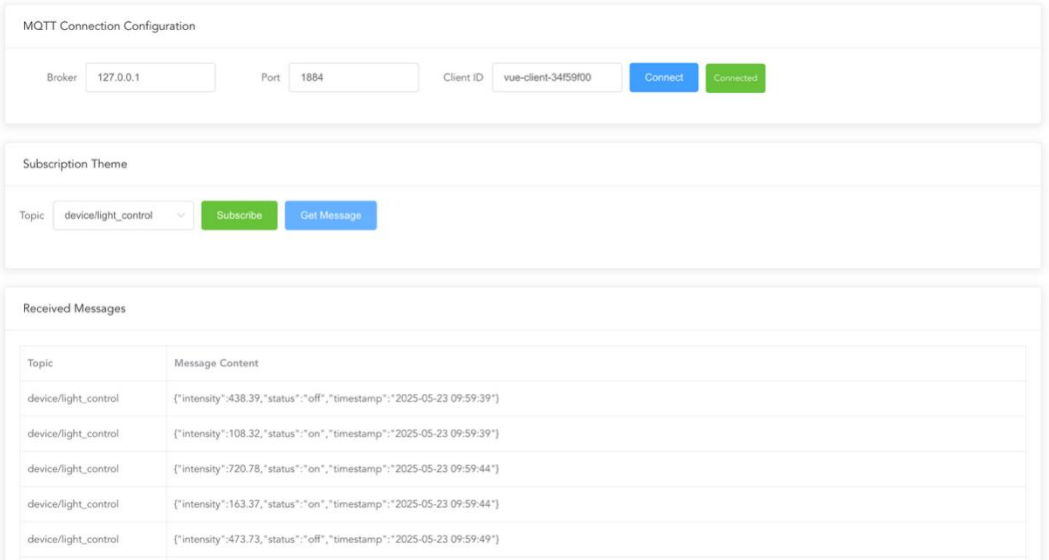


Figure. 8. Message Receiving Page

**Functionality**

After returning from a detail page, users can fetch the latest MQTT messages for the selected topic.

**Instructions**

a. Click the Get Message button.

b. Messages will appear on a table showing the topic name and content (including fields such as status, intensity, and timestamp).

### 3.5. Notes and Tips

You must connect to MQTT before subscribing or retrieving messages.

Available topics include:

- device/temperature (air_conditioner_sensor)
- device/water_heater
- device/light_control
- device/surveillance_camera

After subscribing, topic tags will appear. Clicking a tag lets you revisit the corresponding device page.

## 4. Air Conditioner

### 4.1. Page Overview

This page displays the temperature data monitored by the air conditioner. It includes real-time temperature readings, a historical data table, and a dynamic chart showing temperature variations over the last two minutes.

### 4.2. Real-time Data

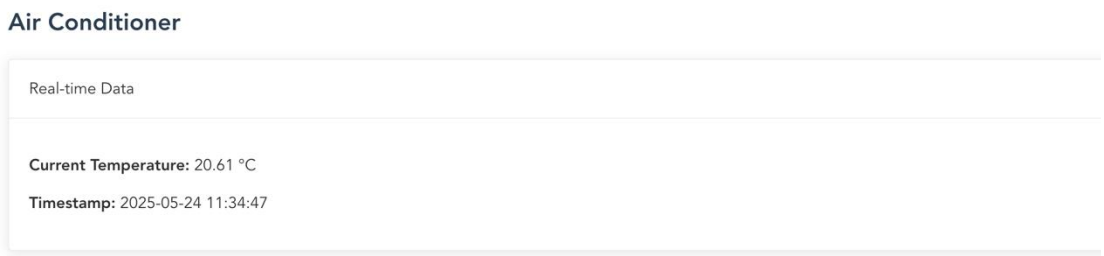



Figure. 9. Air Conditioner Real-time Data

**Functionality**

- The current room temperature is displayed in real time.
- Each reading includes the temperature value and its corresponding timestamp.
- If data is not available, a message will indicate the absence of recent values.

**Instructions**

a. Wait a few seconds for the system to fetch the latest data.

b. The real-time temperature will appear under the "Current Temperature" label.

c. The timestamp shows when the reading was recorded.

### 4.3. Historical Data


Figure. 10. History Data

**Functionality**

- Displays a scrollable table of past temperature values.
- Each row contains a timestamp, and the temperature recorded at that moment.
- Data is automatically updated every five seconds.

**Instructions**

a. Scroll vertically to view historical temperature records.
b. Data is listed in reverse chronological order, with the most recent values at the top.

### 4.4. Temperature Variation Chart


Figure. 11. Temperature Variation Chart

**Functionality**

- A line chart visualizes temperature changes over the last two minutes.
- The chart updates dynamically as new data is received.

**Instructions**

a. Observe the curve to analyze short-term temperature trends.
b. The vertical axis represents temperature in degrees Celsius.
c. The horizontal axis is time-based (not labeled for simplicity), showing continuous updates.

**Notes and Tips**

- The system automatically refreshes every 5 seconds.
- If no recent values are available within the last five seconds, the real-time section will display "No real-time data available."
- Ensure MQTT and backend services are running properly to guarantee data collection.

## 5. Water Heater

### 5.1. Page Overview

This page is designed to provide users with comprehensive information about the water heater in smart home systems. It offers real-time data, historical records, and visual charts to help users understand the operation status and performance of the water heater.

### 5.2. Real - time Data

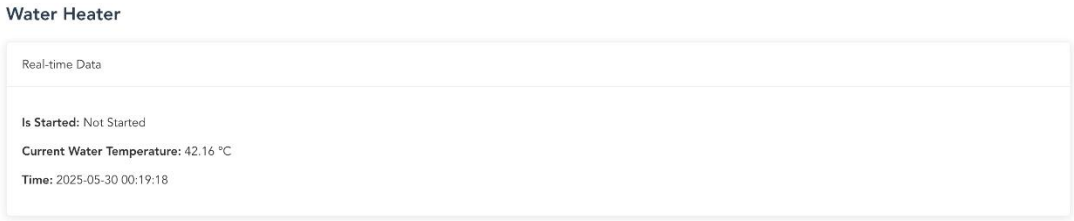



Figure. 12. Real-time Data

**Functionality**

- The page shows the status of the water heater, indicating whether it is running, idle, or in a faulty state.
- It displays the real - time water temperature, which is crucial for users to know if the water is at the desired temperature for use.
- Each data point comes with a corresponding timestamp, allowing users to track when the data was recorded.
- If real-time data is unavailable, a message will clearly state the lack of recent values.

**Instructions**

a. Wait a few seconds for the system to retrieve the latest data from the water heater.

b. The real-time status and water temperature will be presented under the "Current Status" and "Current Water Temperature" labels respectively.

c. The timestamp shows when the reading was taken.

### 5.3. Water Temperature Variation Chart

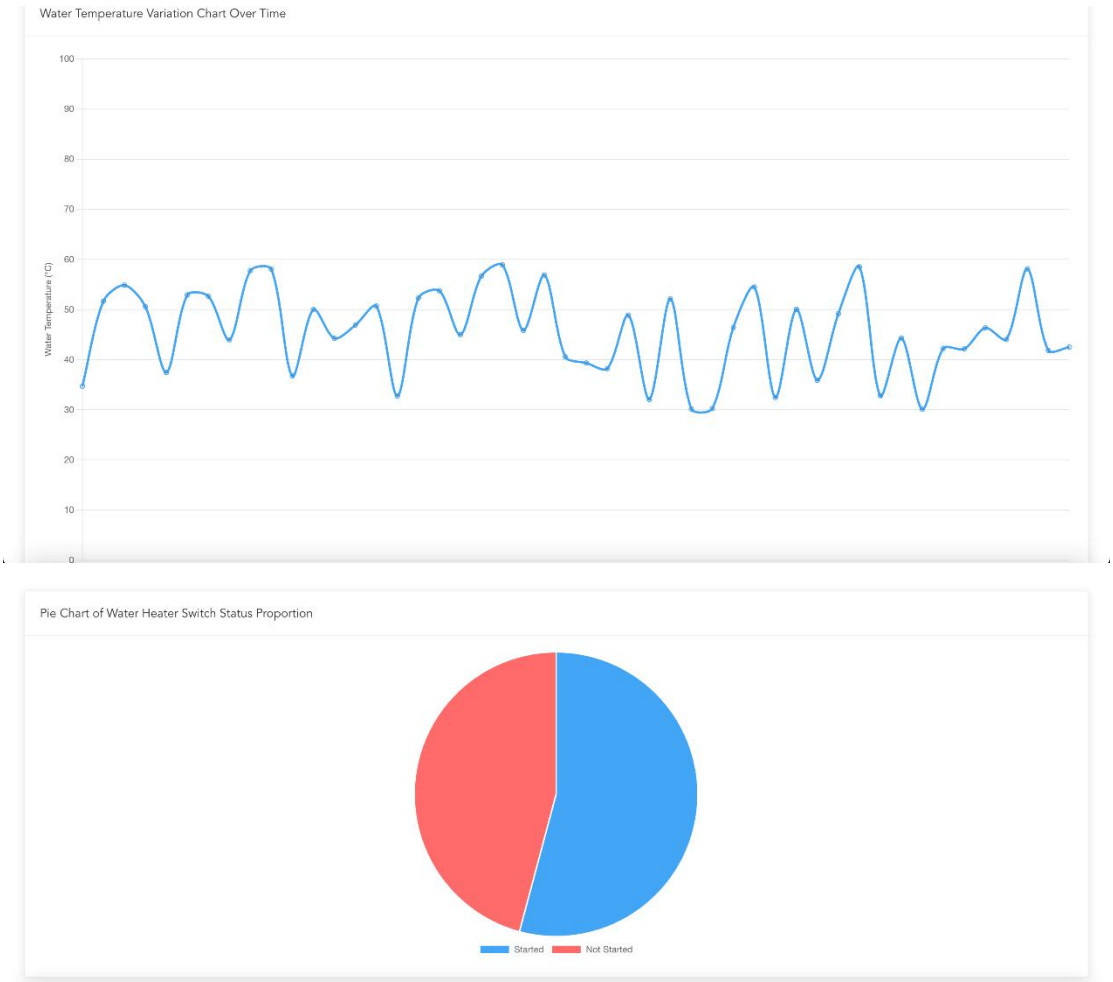



Figure. 13. Water Temperature Variation Chart

**Functionality**

- A-line chart visualizes the changes in water temperature over the last two minutes. This helps users quickly understand the temperature trends and whether the water heater is working effectively.
- The chart updates dynamically as new data is received, providing real-time insights into the water heater's performance.

**Instructions**

a. Observe the curve on the chart to analyze the short-term temperature trends of the water heater.

b. The vertical axis represents the water temperature in degrees Celsius.

c. The horizontal axis is time-based (not labeled for simplicity), showing continuous updates as new data arrives.

### 5.4. Notes and Tips

- The system automatically refreshes the data every 5 seconds to keep the information up to date.
- If no recent values are available within the last five seconds, the real-time section will display "No real-time data available."
- Ensure that the MQTT and backend services are running properly to guarantee the

normal collection and display of water heater data.

- You notice any abnormal temperature changes or statuses; it may indicate a problem with the water heater. Contact the maintenance personnel on time.

## 6. Lighting Controller

### 6.1. Page Overview

This page allows users to monitor and control smart lighting devices in real time. It displays the current light control status, intensity level, and time. Two dynamic charts provide a visual representation of lighting variations and switch status statistics.

### 6.2. Real-time Data

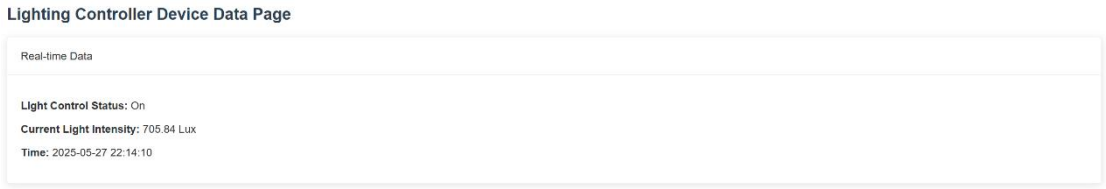



Figure. 14. Real-time Data

**Functionality**

- Light Control Status: Indicates whether the device is ON (Too Bright / Too Dark) or OFF.
- Current Light Intensity: Displayed in Lux (Lx), based on simulated or received sensor values.
- Time: Timestamp of the latest data received.

This section updates automatically as data is received through the MQTT topic device/light_control

### 6.3. Light Intensity Variation Chart

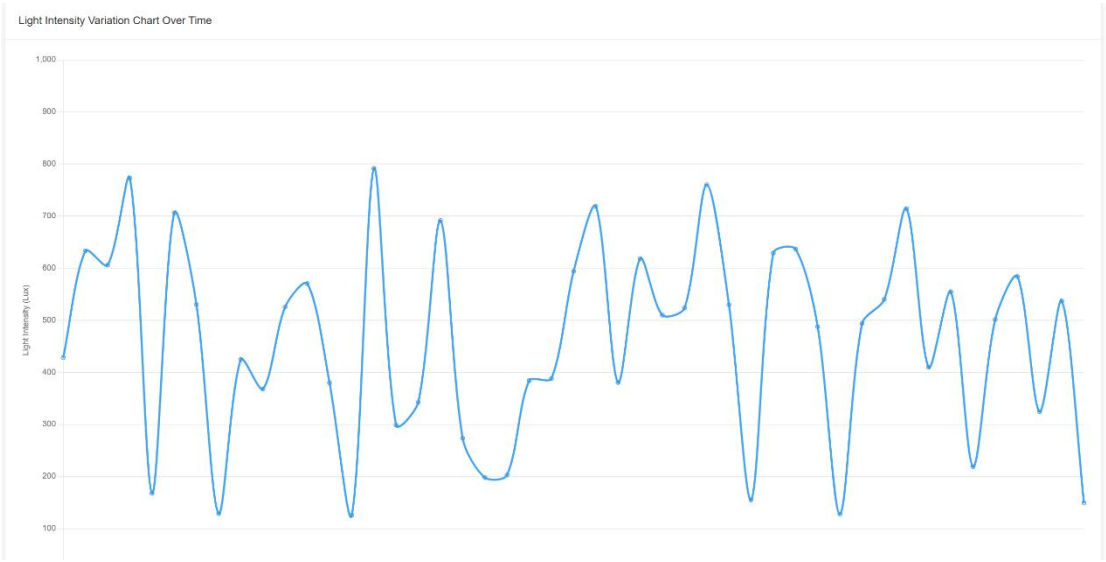



Figure. 15. Light Intensity Variation Chart

**Functionality**

- A line chart visualizes the changes in light intensity (Lux) over time. This helps users observe fluctuations caused by environmental simulations or manual adjustments.
- The chart updates dynamically as new data is received from the database, providing real-time insights into the lighting environment.
- The chart reflects both automated simulation changes and user-triggered actions, offering a comprehensive view of the lighting dynamics.

**Instructions**

a. Observe the curve on the chart to analyze the short-term trends in light intensity.
b. The vertical axis represents the light intensity in Lux.
c. The horizontal axis is time-based (not labeled for simplicity), showing continuous updates as new data arrives.

### 6.4. Light Control Status Bar

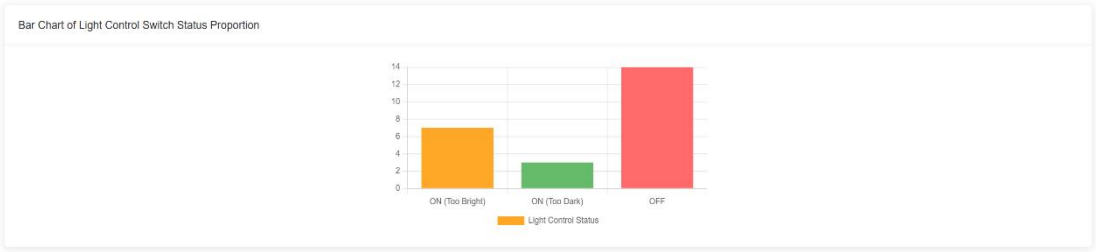



Figure. 16. Light Control Status Bar

This bar chart summarizes the frequency of different switch states:

1. ON (Too Bright)
2. ON (Too Dark)
3. OFF

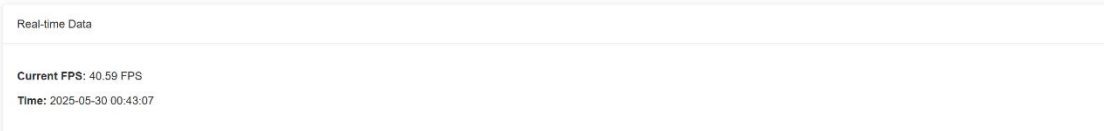
The chart helps users understand the distribution of lighting conditions and control behaviors over time. It refreshes in real time with each status update.

## 7. Surveillance Camera

### 7.1. Page Overview

This page is dedicated to surveillance camera systems. It presents real-time information about the camera feed, including the current frames per second (FPS) and the time. Additionally, it features an FPS variation chart over time to help analyze the camera's performance. There are also two main interactive sections: one for the original camera feed with controls like enabling/disabling the camera, flipping it, and going full - screen; and another for the YOLOv8 detection results, which can start object detection and display the outcomes.

### 7.2. Real-time Data



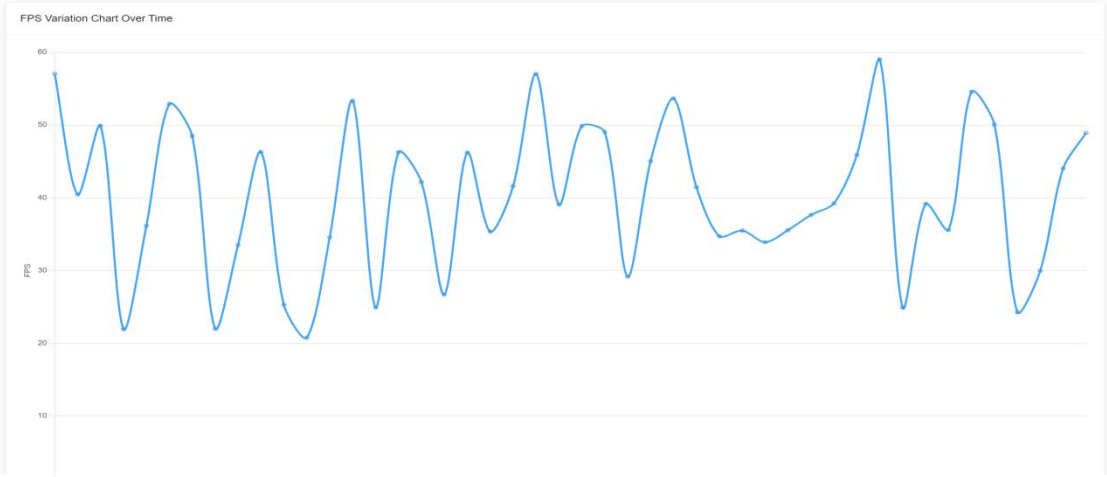



Figure. 17. Real-time Data

**Functionality**

- A line chart visualizes the changes in frames per second (FPS) of the surveillance camera over time. This helps users quickly understand the performance trends and identify whether the camera is operating smoothly.
- The chart updates dynamically as new FPS data is received, providing real-time insights into the camera's performance.

**Instructions**

a. Observe the curve on the chart to analyze the short-term FPS trends of the surveillance camera.

b. The vertical axis represents the frames per second (FPS), indicating how many frames the camera processes each second.

c. The horizontal axis is time-based （not labeled for simplicity）, showing continuous updates as new data arrives.

### 7.3. YOLO Object

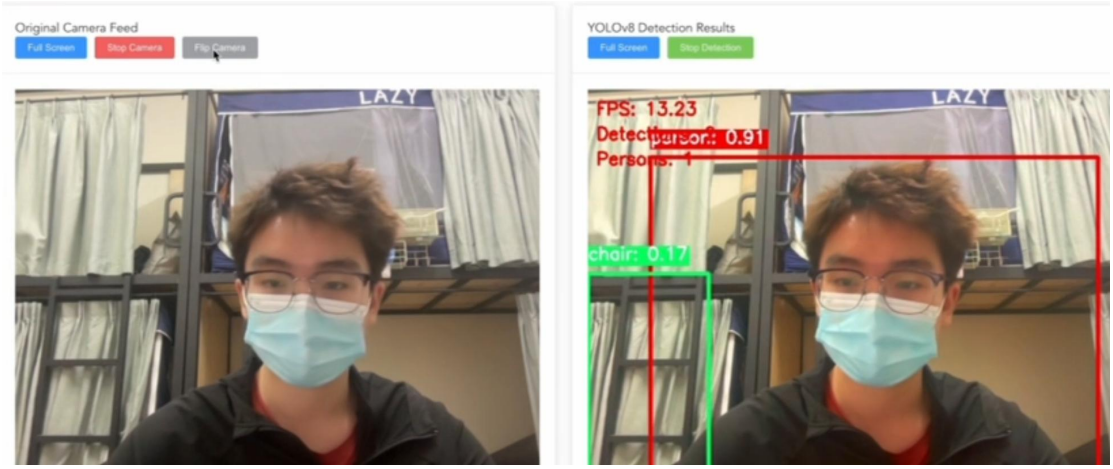



Figure. 18. Yolo Detection

#### 7.3.1. Function Overview

YOLO is a real-time object detection algorithm, with its core advantage being the fast

and accurate identification of multiple objects in images or videos. In this monitoring system, YOLOv8 is integrated to process the raw camera video stream, capable of real-time detection and annotation of various objects in the video, such as people, vehicles, animals, etc., providing users with richer monitoring information.

7.3.2. Interface Display

YOLOv8 Detection Results Card: On the page, there is a dedicated card for displaying YOLOv8 processing results. The card is titled "YOLOv8 Detection Results", where users can intuitively view the video feed processed by YOLOv8.

### 7.4. Operation Buttons

Full Screen Button: Users can click the "Full Screen" button to switch the YOLOv8-processed video feed to full-screen mode for a clearer view of detection results. This button is available when the camera video stream is active, and YOLO detection is enabled.

Start/Stop Detection Button: The "Start Detection" and "Stop Detection" buttons control the activation and deactivation of the YOLOv8 detection function. When the camera video stream is active, users can click "Start Detection" to initiate YOLOv8 processing—the system will begin real-time detection of objects in the video and annotate them on the screen. Clicking "Stop Detection" will halt the detection. During detection, the button will show a loading state to indicate that the system is processing data.

### 7.5. Usage Steps

a. Enable Camera: First, users need to click the "Enable Camera" button to activate the raw camera video stream. The system will request camera access permissions. If granted, the camera video will start playing in real time.

b. Start YOLO Detection: After the camera video stream is active, click the "Start Detection" button to enable the YOLOv8 detection function. The system will send the raw video stream to the backend for processing and display the real-time results in the "YOLOv8 Detection Results" card.

c. View Detection Results: Once YOLOv8 detection is activated, users can see the processed video feed in the card, with detected objects and their categories annotated. Users can also switch to full-screen mode for detailed viewing.

d. Stop Detection: To discontinue object detection, click the "Stop Detection" button. The processed video feed will no longer be displayed on the card, and only a prompt message will appear.

### 7.6. Error Handling

- Camera Not Active: If an attempt is made to start YOLOv8 detection without an active camera video stream, the system will prompt an error message: "Camera is not active" and block the detection function.
- Other Errors: In case of other issues during YOLOv8 processing, the system will display corresponding error messages in the card, prompting users to check their network connection or other potential problems.

## 8. Personal Data

### 8.1. Page Overview

This page allows users to view and update their personal information, such as contact details, ID number, address, and company information. It also provides a password change feature for enhanced account security.

### 8.2. Personal Information

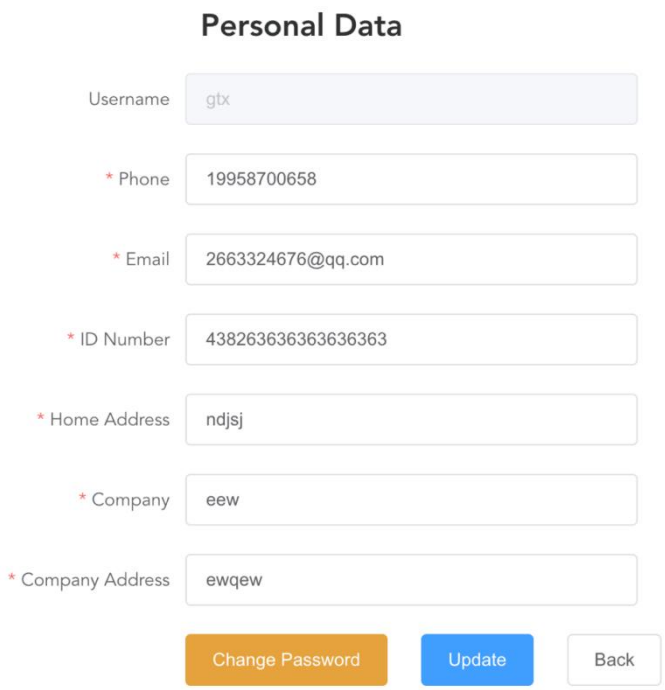



Figure. 19. Personal Data View

**Functionality**

- Displays current user data retrieved from the database.
- Users can update information such as phone, email, ID number, address, and company details.
- The username field is read-only and cannot be changed.

**Instructions**

a. Modify the necessary fields including Phone, Email, ID Number, Home Address, Company, and Company Address.

b. Click the Update button to save changes.

c. A successful message will confirm the update, or an error will appear if the update fails.

d. Click Back to return to the main page without saving changes.

### 8.3. Change Password (Optional)

**Functionality**

Users may choose to update their password for account security.

**Instructions**

a. Click the Change Password button to open the password fields.
b. Enter your Old Password, then your New Password and Confirm New Password.
c. The new password must match the confirmation field.
d. Click Update to apply for changes.

### 8.4. Important

- All fields marked with * are required.
- The email field must follow a valid email format.
- Passwords must match to be accepted.

### 8.5. Notes and Tips

- Always keep your contact and identification details up to date.
- Choose a strong password containing a mix of uppercase, lowercase, numbers, and symbols.
- If the form contains any validation errors, the system will prevent submission and display hints.

## 9. Real-time Device Monitoring

### 9.1. Page Overview

This page provides an overview of real-time statuses and data from four major smart home devices: Air Conditioner, Water Heater, Surveillance Camera, and Lighting Controller. Users can subscribe to devices to receive their latest data, manually refresh the data, or navigate to the detailed view for each device.

### 9.2. Device Status and Data

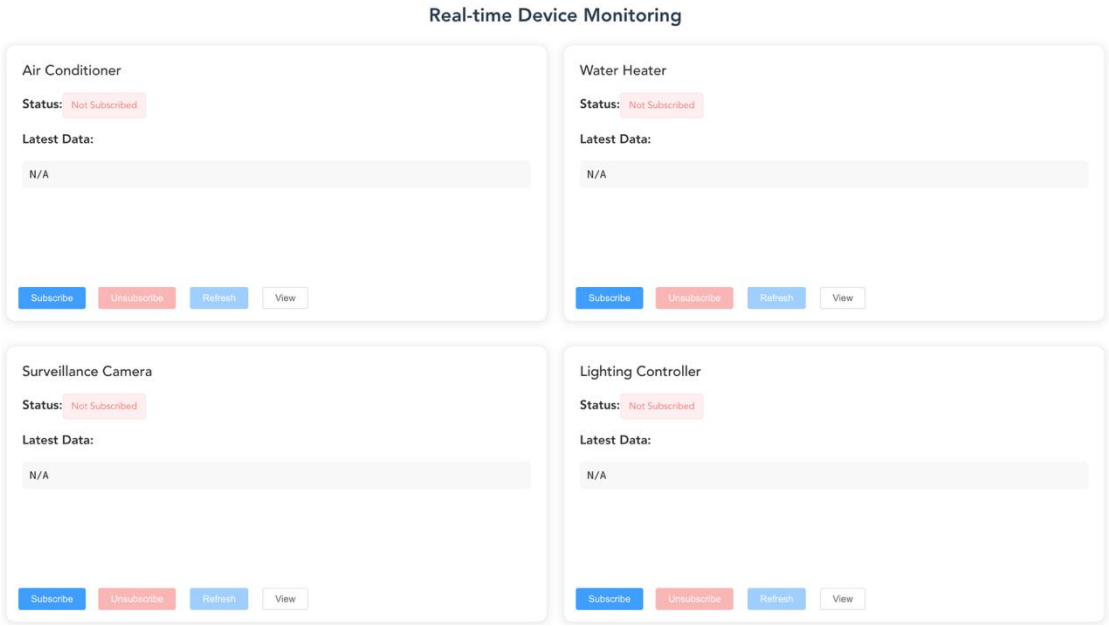



Figure. 20 Device Status and Data

**Functionality**

- Displays the current subscription status (Subscribed or Not Subscribed) of each

device.

- Shows the most recent data received from each device.
- Data fields vary by device type.

For example:

- Air Conditioner includes temperature, humidity, cooling status, and dehumidifying status.
- Water Heater includes temperature, status, and message.
- Surveillance Camera shows frame rate (FPS).
- Lighting Controller shows intensity and status.

**Instructions**

a. If a device is not yet subscribed, click the Subscribe button to begin receiving data.
b. After subscribing, the latest data will be displayed.
c. Use the Refresh button to manually update the displayed data.

### 9.3. Device Operations

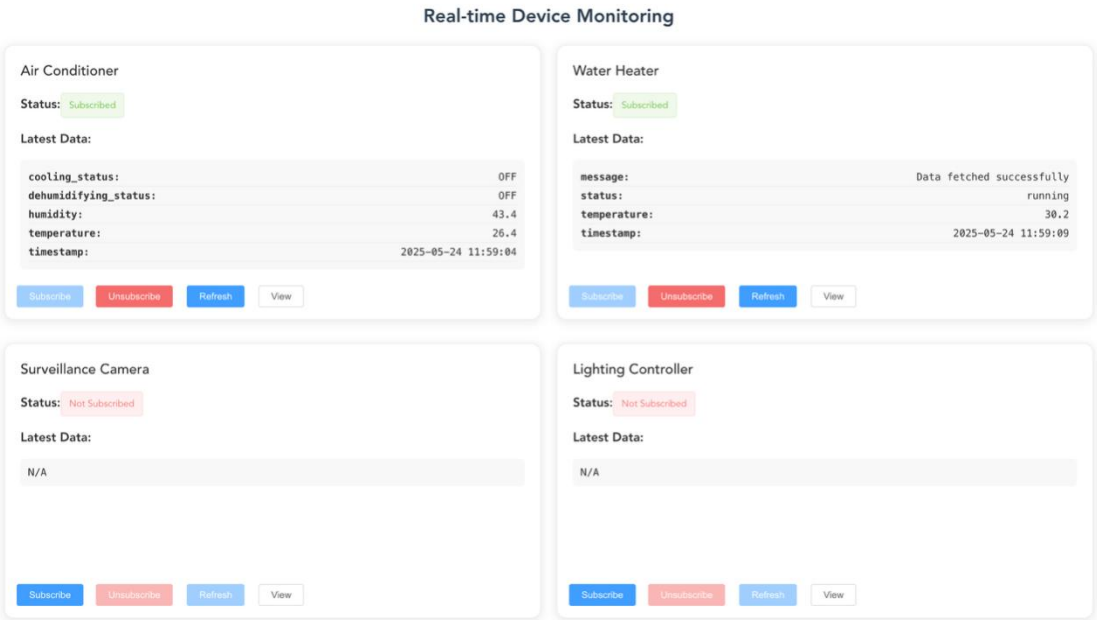



Figure. 21. Device Operations View

**Subscribe**

- Enables real-time data retrieval from the selected device.
- After subscribing, the system fetches and displays the latest available data.

**Unsubscribe**

- Stops data updates for the device.
- The latest data will be cleared from the display area.

**Refresh**

- Requests the latest data from the database or backend for the subscribed device.
- If the device is not subscribed, this button is disabled.

**View**

- Redirects to the device's dedicated detail page, where more in-depth data and visualizations (e.g., line charts) are available.

### 9.4. Notes and Tips

- Data will only appear after the user subscribes to a device.
- Refresh does not function if the device is not subscribed.
- Each device's View button opens a dedicated page for monitoring or controlling that specific device.
- All device cards are arranged side-by-side for quick monitoring and unified control.

## 10. Deivce Control

### 10.1. Page Overview

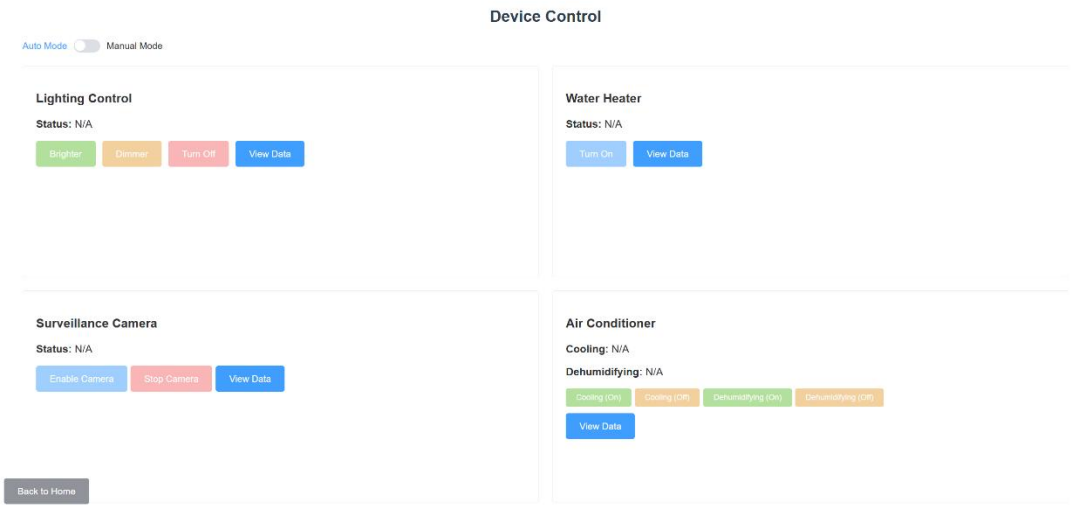



Figure. 22. Device Control Page

The Device Control page serves as a centralized dashboard for managing all smart home devices. It displays four key modules:

- Lighting Control
- Water Heater
- Surveillance Camera
- Air Conditioner

Each device panel includes:

- A status indicator showing the current device state.
- Control buttons to operate the device in manual mode.
- A "View Data" button to display the latest sensor readings.
- A "Refresh" button to manually fetch the newest data from the backend.
- A "Close" button to hide the data panel.

At the top of the page, users can toggle between Auto Mode and Manual Mode, which determines how each device operates and displays data.

## 10.2. Auto Mode

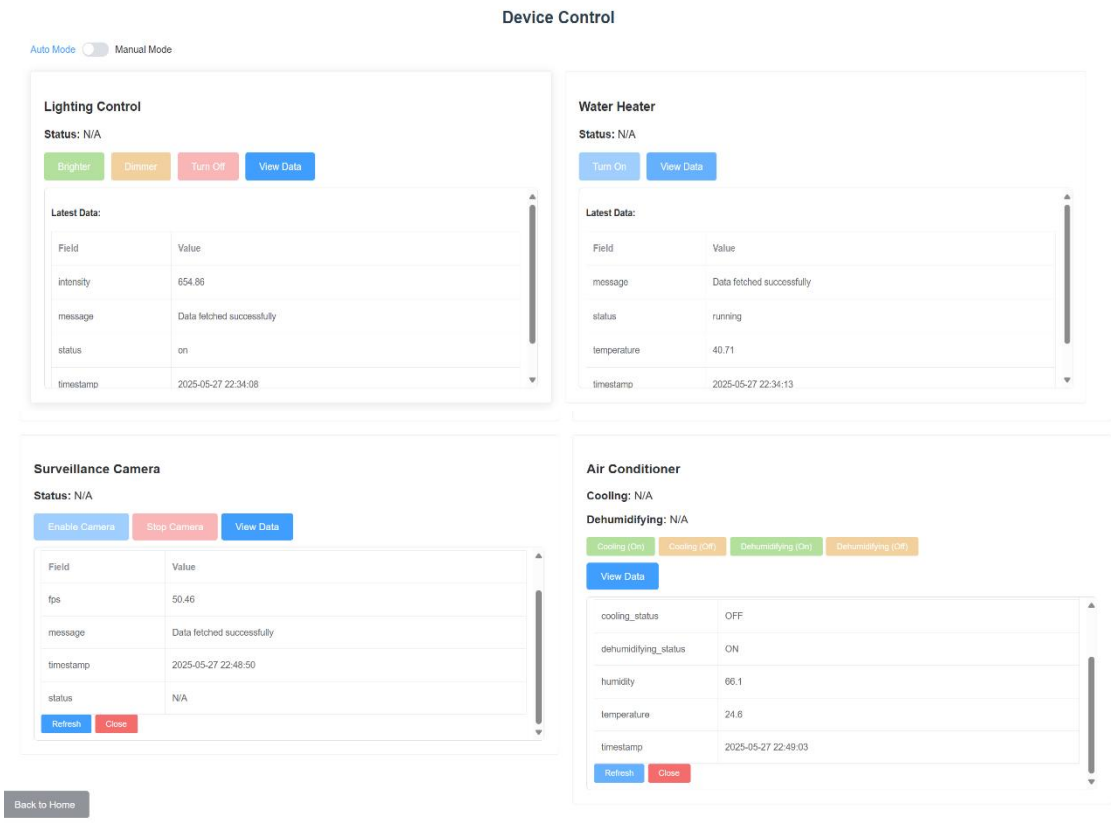



Figure. 23. Auto Mode Behavior

When Auto Mode is enabled:

a. The system operates based on real-time sensor data and predefined control rules.
For example, the air conditioner automatically starts cooling when the temperature is too high.

b. All device status indicators (top of each card) are updated automatically.

Clicking "View Data" reveals a detailed data panel containing fields such as:

- Intensity / Temperature / Humidity / FPS
- Device Status (e.g., "running", "on", "OFF")
- Timestamp of the latest data

c. Pressing the "Refresh" button fetches the most recent data from the database.

Note: In Auto Mode, control buttons are disabled or have no effect on the system behavior.

## 10.3. Manual Mode Behavior

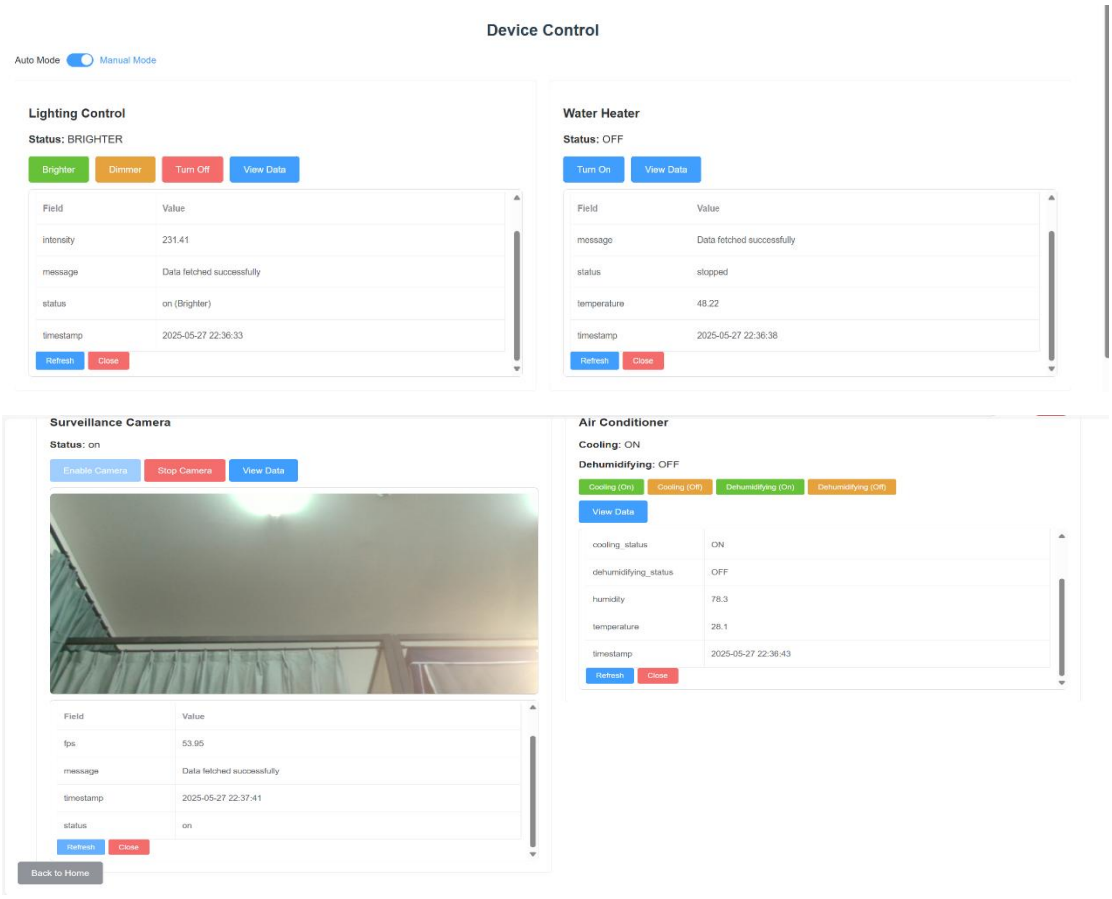



Figure. 24. Manual Mode Behavior

**Manual Mode**

a. Users can directly control each device via the provided buttons.
   - Lighting: Brighter / Dimmer / Turn Off
   - Water Heater: Turn On / Turn Off
   - Surveillance Camera: Enable / Stop
   - Air Conditioner: Cooling / Dehumidifying (On/Off)

b. Device status reflects user-triggered actions.

c. The system saves manual actions to the backend and reflects them in the view.

d. "View Data" shows the latest recorded values (manually or automatically updated).

e. "Refresh" updates the view in real time based on backend data.

**Additional for Surveillance Camera**

- In manual mode, the camera will display a live feed image.
- Disabling it will hide the video and reset its status to "OFF".

### 10.4. Return to Home Functionality

At the bottom of the page, the "Back to Home" button provides a navigation shortcut that brings users back to the main dashboard or welcome page. It ensures smooth transitions between modules and supports a better user experience.

## 11. Data History

### 11.1. Page Overview

The Data History page serves as a centralized location for users to access historical data from various smart home devices. It provides an overview of available devices and allows users to view detailed historical data for each device. This page is accessible from the main dashboard and provides a seamless way to explore past device readings and statuses.

### 11.2. Device Selection

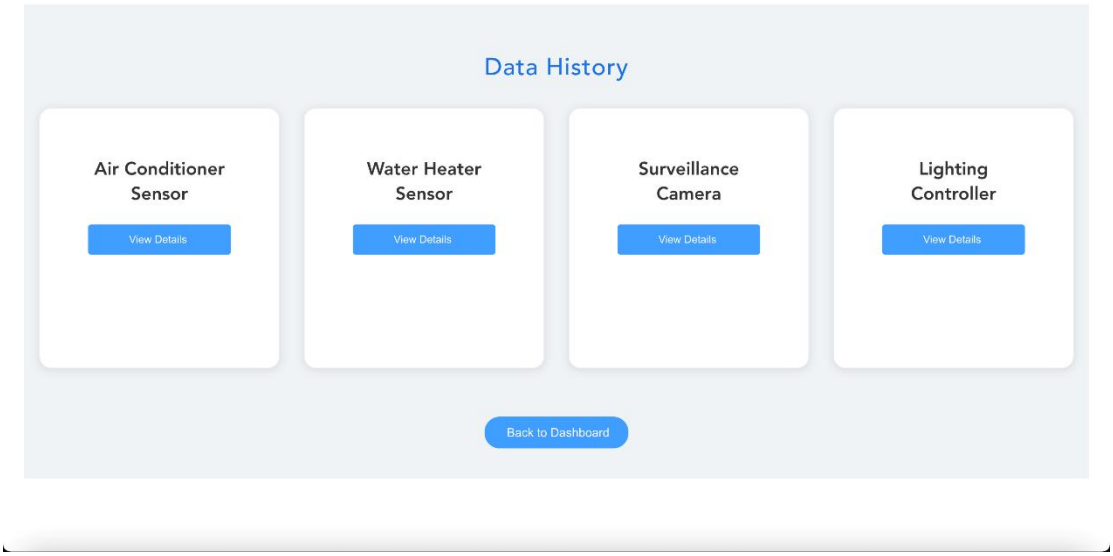



Figure. 25. Device Selection

**Functionality**

Users can select a specific device from a list of available smart home devices to view its historical data. The devices include Air Conditioner Sensor, Water Heater Sensor, Surveillance Camera, and Lighting Controller.

**Instructions**

a. Navigate to the Data History page.
b. Scroll through the grid of device cards.
c. Each device card displays the device title.
d. Click the "View Details" button on the device card of your choice.

### 11.3. Example: Air Conditioner Sensor History

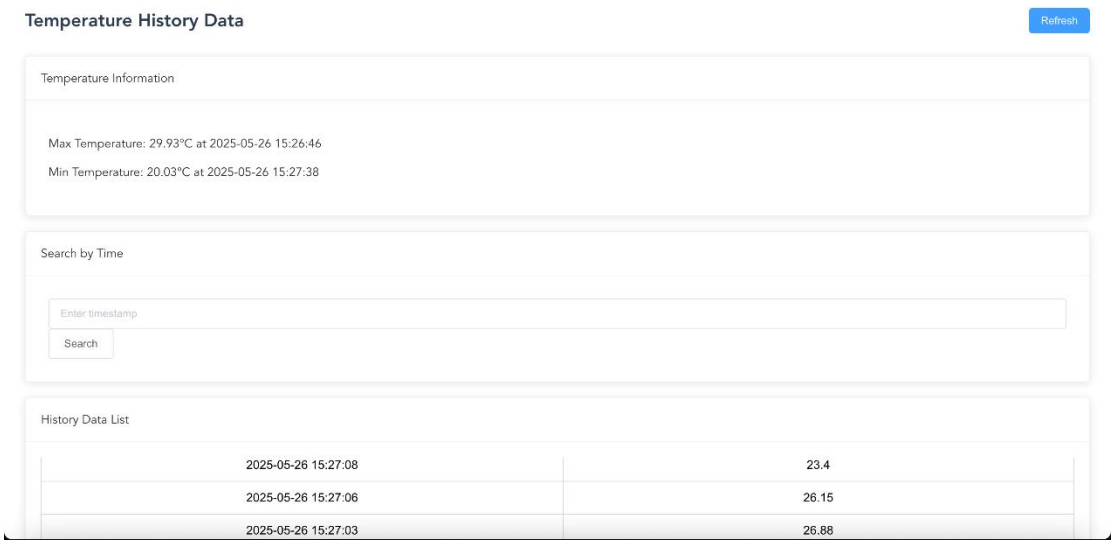



Figure. 26. Example of data history

**Functionality**

This page displays the historical temperature data monitored by the air conditioner sensor. It includes a scrollable table of past temperature values, with each row containing a timestamp and the temperature recorded at that moment. Additionally, it shows the maximum and minimum temperatures along with their corresponding timestamps and provides a time search feature.

**Instructions**

a. After clicking "View Details" for the Air Conditioner Sensor, you will be redirected to this page.

b. Scroll vertically to view historical temperature records. Data is listed in reverse chronological order, with the most recent values at the top.

c. To see the maximum and minimum temperatures, look at the "Temperature Information" card. It shows the max and min temperatures in °C and the timestamps when they were recorded.

d. To search for data at a specific time, enter the timestamp in the "Enter timestamp" field and click the "Search" button. If data is found, it will display the temperature at that time; otherwise, it will show a "No data found for the given time" message.

e. To refresh the data, click the "Refresh" button at the top - right corner of the page.

## 12. Smart Home Assistant

### 12.1. Overall Functionality

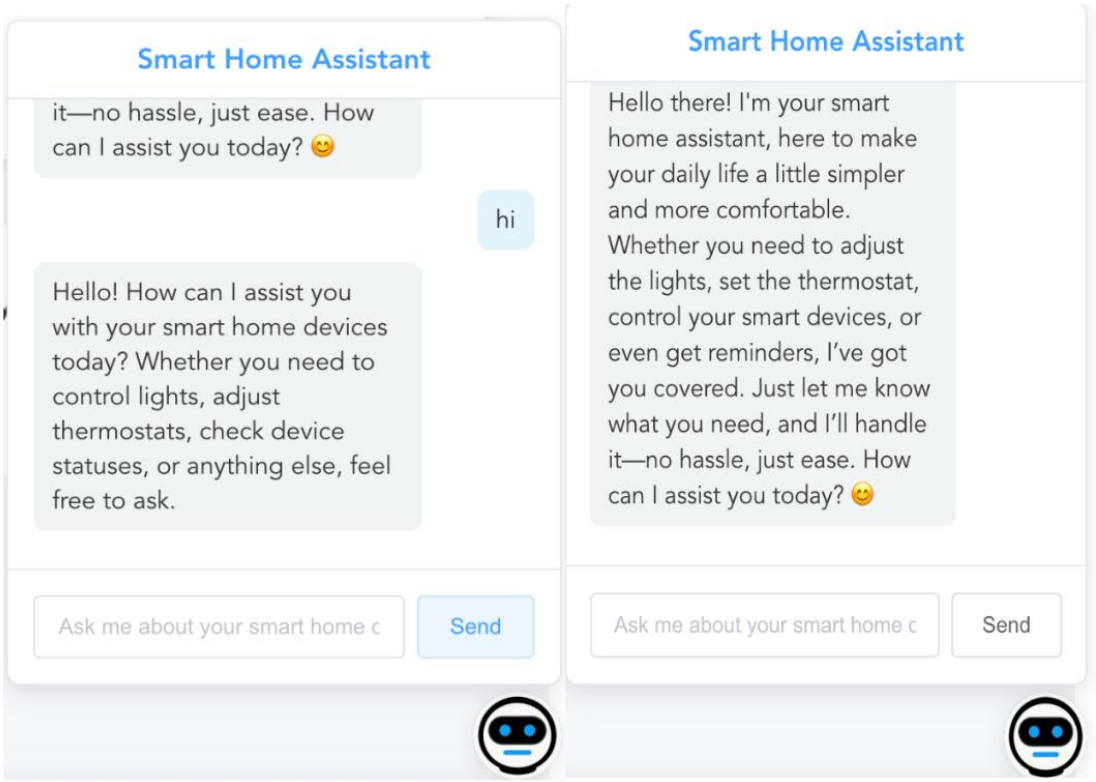



Figure. 27. Smart Home Assistant

The HomePage.vue file is a Vue.js single - file component that serves as the home page for a smart home system. It provides users with an intuitive interface to access various features of the system, including device monitoring, control, and data query, and also includes a smart AI assistant for interactive communication.

## 12.2. Template Section

### 12.2.1. Welcome Area

It uses an el - card component to display a welcome message, a description of the system's capabilities, and quick links. The quick links allow users to navigate to the dashboard, view personal data, or log out of the system.

### 12.2.2. Feature Grid

Three el - col components are used to display three key features of the smart home system: real-time monitoring, device control, and data history. Each feature is wrapped in a clickable el - card, and clicking on it will navigate the user to the corresponding page.

### 12.2.3. Smart AI Assistant

There is a floating AI icon in the lower - right corner of the screen. Clicking on it will toggle the visibility of the AI chat window. The chat window displays the conversation history and allows users to send messages to the AI assistant.

## 12.3. Script Section

### 12.3.1. Data Properties

The component defines several data properties, including user input, chat messages, the visibility of the chat window, API key, model ID, and API URL.

#### 12.3.2. Mounted Hook

When the component is mounted, it sends an initial request to the API to get a welcome message from the AI assistant and adds it to the chat messages.

## 13. Conclusion

The Smart Home System offers an integrated and user-friendly platform for managing various aspects of a modern intelligent living environment. Through its well-structured interface, users can securely log in or register, access real-time device statuses, control appliances, and review historical data—all from a centralized dashboard. The inclusion of AI-assisted interaction further enhances usability by providing responsive support for queries and guidance on operations.

Each module, from the air conditioner to surveillance systems, has been thoughtfully designed to deliver both real-time monitoring and detailed analytics, ensuring users maintain full awareness and control of their home ecosystem. The personal data section emphasizes security and flexibility, allowing for easy updates and password management to protect user privacy.

With robust MQTT integration, dynamic visual charts, and intelligent assistant support, the system ensures a seamless experience that bridges the gap between technology and daily comfort. As smart home technologies continue to evolve, this platform lays a strong foundation for future expansion and smarter living.