CS350 Software Engineering
SafeHome Project

User Manual

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I. Introduction

A. About SafeHome

SafeHome is a new product for home automation. Private homeowners or small business can now think of using a Universal device that they can use to access their property with much ease, flexibility and mobility. SafeHome makes this possible by bringing together all the innovative ideas relating to manage the work of a house owner using the latest technology equipments both remotely and locally. Automation has been made feasible by the widely used wireless equipments.

The product is quite comprehensible in the current market when more and more people are becoming mobile and ubiquitous. Amongst the most thought about targets, SafeHome focuses on making the home absolutely safe. It provides a convenient way to secure the property for those who require both accessibility and quality of service.

To start with, the first version of SafeHome will include only the security and surveillance functions. SafeHome is thought to attract huge number of customers and make a high turnover over a year. Besides fulfilling the basic requirements of security and surveillance, this product will also be standardized to cope with the needs to become Universal device by adding additional functionalities like management, subscription, etc.

B. Conventions used in this manual

To ensure clarity and consistency throughout this manual, the following conventions are used:

- **Bold text** — indicates buttons, menu items, UI components, or important interface elements.
  *Example: Click **Add User***
- *Italic text* — used for notes, hints, or important emphasis.
  *Example: *This action requires Homeowner permissions.*
- `Monospaced code` — used for commands, filenames, directories, and code snippets.
  Example: Run the program using `python main.py`
- **Numbered lists** — used for step-by-step instructions that must be followed in order.
- **Bulleted lists** — used for definitions, options, or additional information that does not require sequence.
- **Screenshots or figures** — included where helpful to guide users through interface navigation; each figure will have a caption describing its purpose.
  Terminology — the manual uses SafeHome-specific terms consistently:
  - **Homeowner** — primary administrator with full system access
  - **Guest User** — secondary, limited-access user
    Safety Zone — a monitored area configured in the system
  - **Log Entry** — a recorded system event for auditing

II. System Requirements

A. Supported platforms

SafeHome is implemented as a Python-based simulation and can be run on common desktop environments. The following platforms are officially supported:

Operating Systems

- macOS (tested on macOS 12 Monterey and later)
- Windows (tested on Windows 10 and Windows 11)

Supported Development Environments

- Visual Studio Code (VSCode)
  Recommended for running, debugging, and editing the SafeHome source code.
  SafeHome has been developed and tested primarily using VSCode on both macOS and Windows.

Python Version

- Python 3.14 or later
- Required to run the SafeHome program and all associated modules.

B. Software requirements

Package & Environment Manager

- **uv**: Used to create virtual environments and install dependencies.

Install **uv** by (**virtual environment** is recommend):

```
pip install uv
```

All required packages are installed automatically using:

```
uv sync
```

Version Control

- **Git**: Required for project collaboration and source code management.

Project Dependencies

All Python dependencies (testing tools, coverage, utilities, etc.) are defined in the project's **pyproject.toml** and will be installed automatically by `uv sync`.

III. Installation & Setup

1. Unzip SafeHome

- **Linux / MacOS:**

```
unzip SafeHome.zip -d /path/to/install/
cd /path/to/install/SafeHome
```

- **Windows:**
  Right-click → Extract All… → choose folder, then open the folder.

2. Install uv

```
python3 -m pip install uv
```

3. Sync dependencies

Inside the SafeHome folder, simply run:

```
uv sync
```

After this, SafeHome is ready.

IV. Launching SafeHome

1. Open a terminal (cmd/git bash) and navigate to the SafeHome source folder:

```
cd /path/to/install/SafeHome/src
```

2. Run SafeHome using uv:

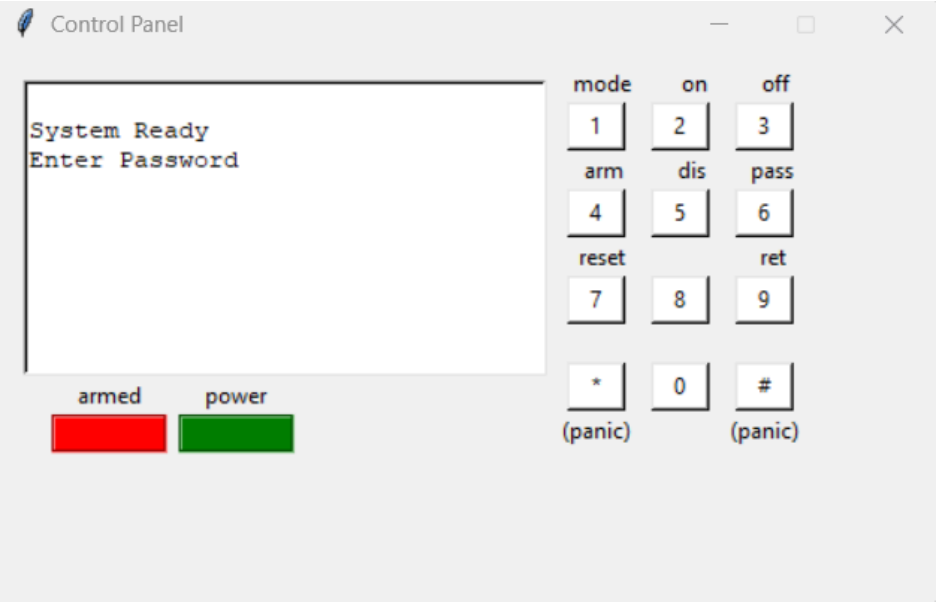
```
uv run python main.py
```

SafeHome will start, and you can interact with the web interface and control panel.

V. Overview of the User Interface and Main Features

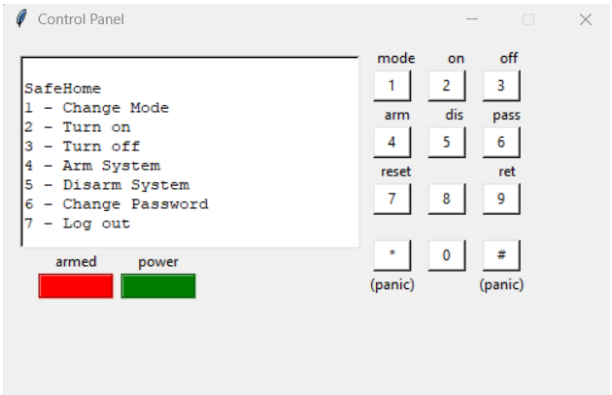
A. About Control Panel

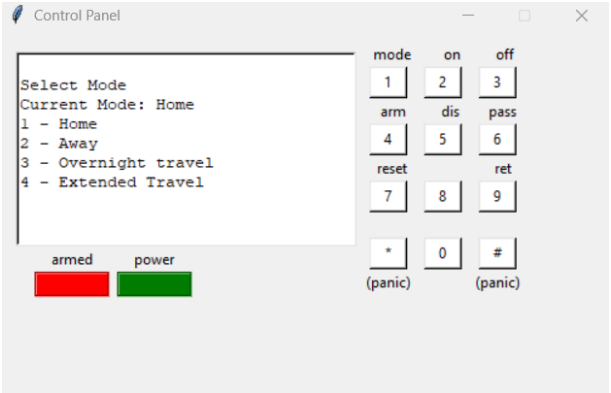
Control Panel is the primary physical interface for interacting with the SafeHome security system. It is a compact device equipped with a numeric keypad, a small status display, and two indicator LEDs that provide quick visual feedback on the system state.



Key Features

- Enter 4-digit number password to login
- User can change SafeHome mode from control panel
- Turn on/off System
- Arm/Disarm All devices
- Change Password of Control Panel
- Call Emergency Service
- **armed led** shows device is armed
- **power led** shows system is on



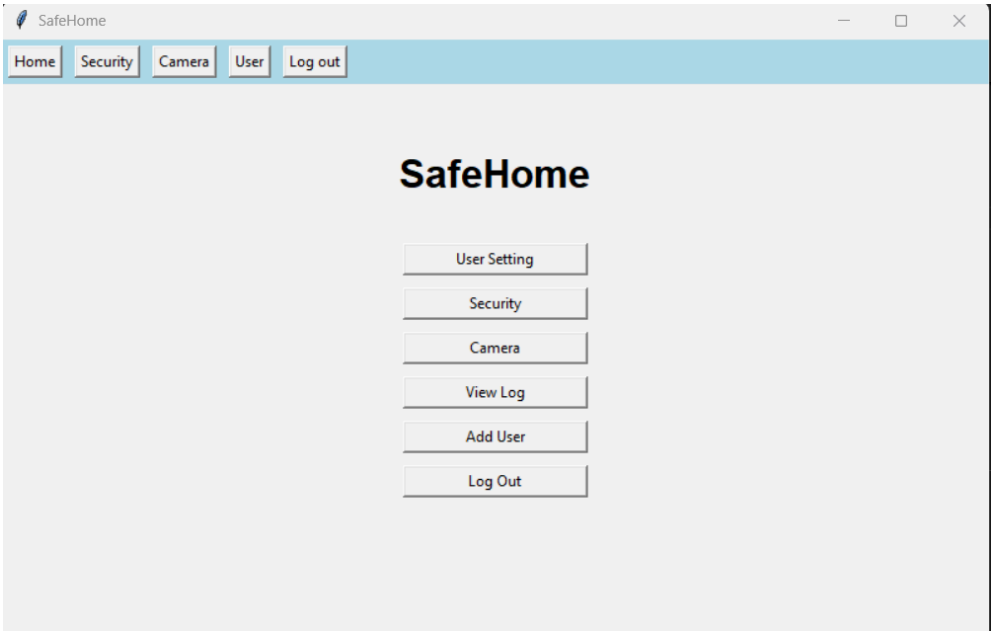


B. About Web Interface

Web Interface provides a simple, user-friendly way to monitor and control the SafeHome system from any computer. It displays system status, camera feeds, user settings, and security logs through a clear navigation menu. Users can manage devices, review alerts, and update configuration without using the physical control panel.

i. Home Page

Home Page serves as the main dashboard of the SafeHome Web Interface, offering quick access to key features such as User Settings, Security Controls, Camera View, and Security Logs.

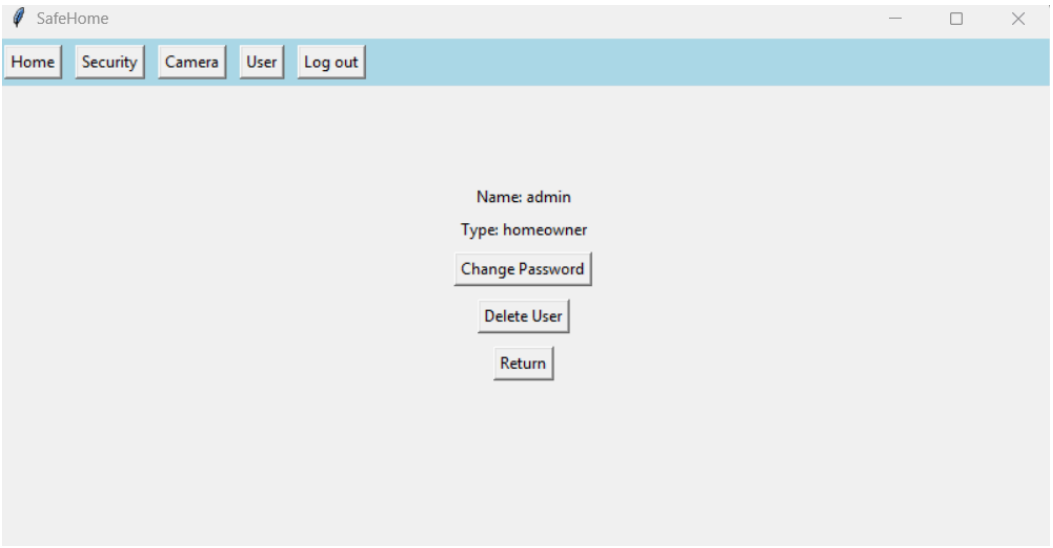


Key Features

- **Header** – Allow user to navigate to Home, Security, Camera, User Setting, and Log out.
- **User Setting Button** – Navigate to User Setting Page
- **Security Button** – Navigate to Security Page
- **Camera Button** – Navigate to Camera Page
- **View Log Button** – Navigate to View Log Page
- **Add User Button** – Navigate to Add User Page
- **Log Out Button** – Allow user to log out from SafeHome

ii. User Setting Page

User Setting Page displays the user's profile details and provides options to change the account password or remove a guest user. It offers a clean interface for managing user information and maintaining account security.

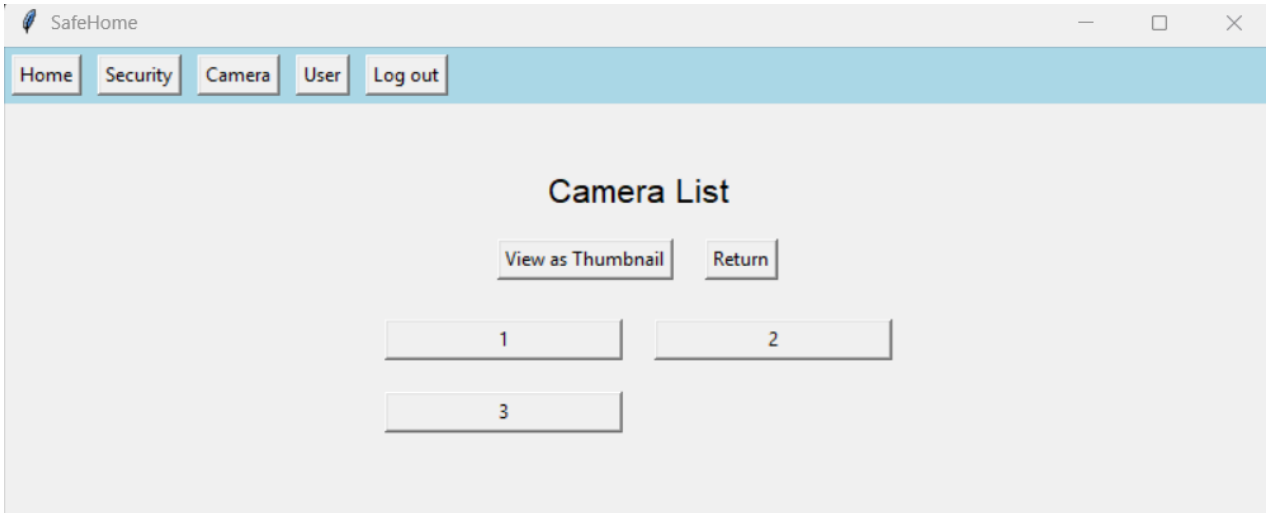


Key Features

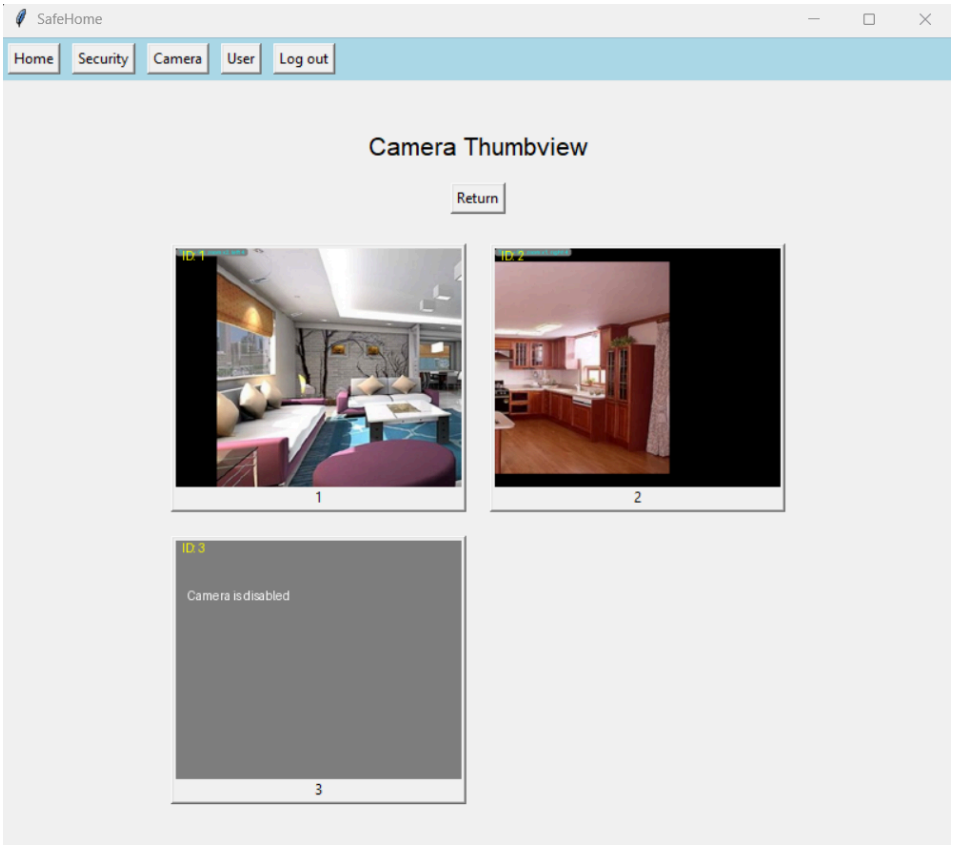
- View user details such as name and role
- Change account password
- Remove guest user accounts (Homeowner cannot be removed)
- Quick navigation back to the Home Page

iii. Camera Page

Camera Page provides access to all connected cameras in the SafeHome system. It displays each camera as a button in a list, allowing users to select and view live footage, check camera status, and control movement. A thumbnail view option is also available for quickly scanning all cameras at once.



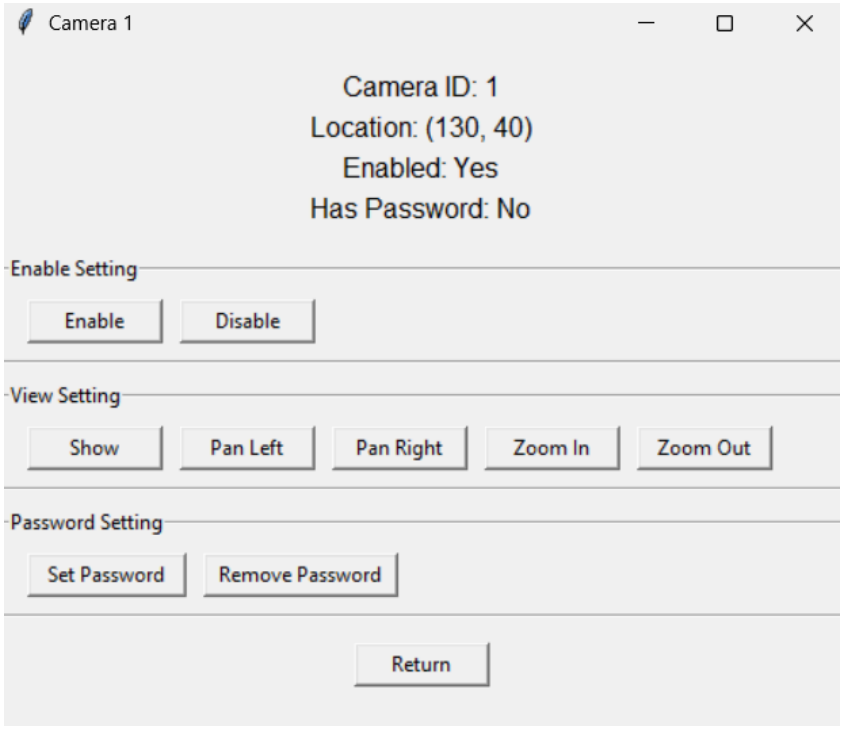
Thumbnail View

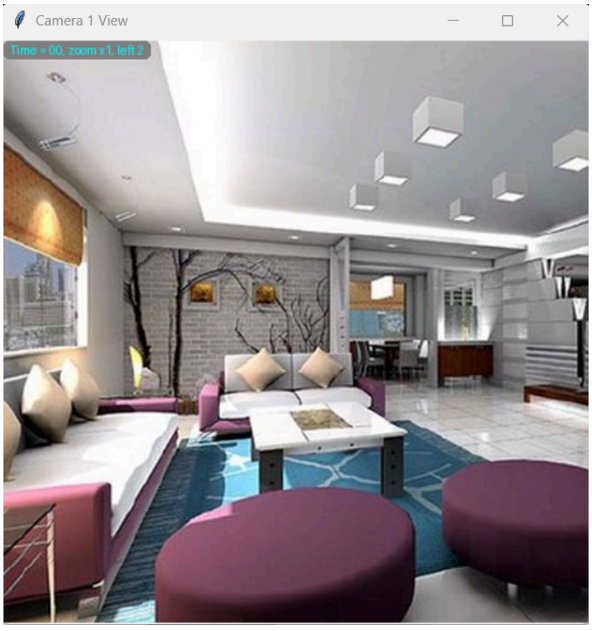


Key Features

- List of all cameras as selectable buttons
- Thumbnail view option to preview all cameras at once
- Live view of the selected camera
- Camera status display (online/offline, signal, etc.)
- Camera controls including zoom in/out and pan left/right
- Quick navigation back to the Home Page

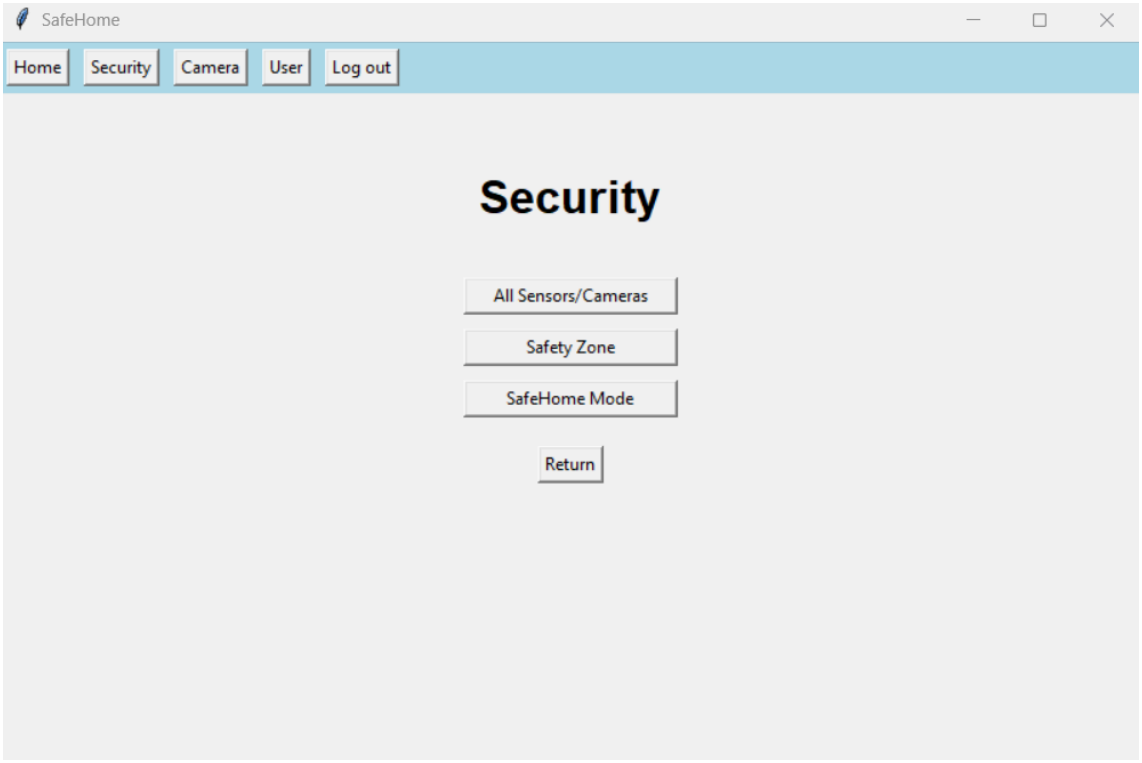
Live view of the selected camera and **Camera status** display





iv. Security Page

Security Page acts as a central hub for managing the main security functions of SafeHome. It presents a set of buttons leading to key security modules, along with a return button for quick navigation back to the Home Page.

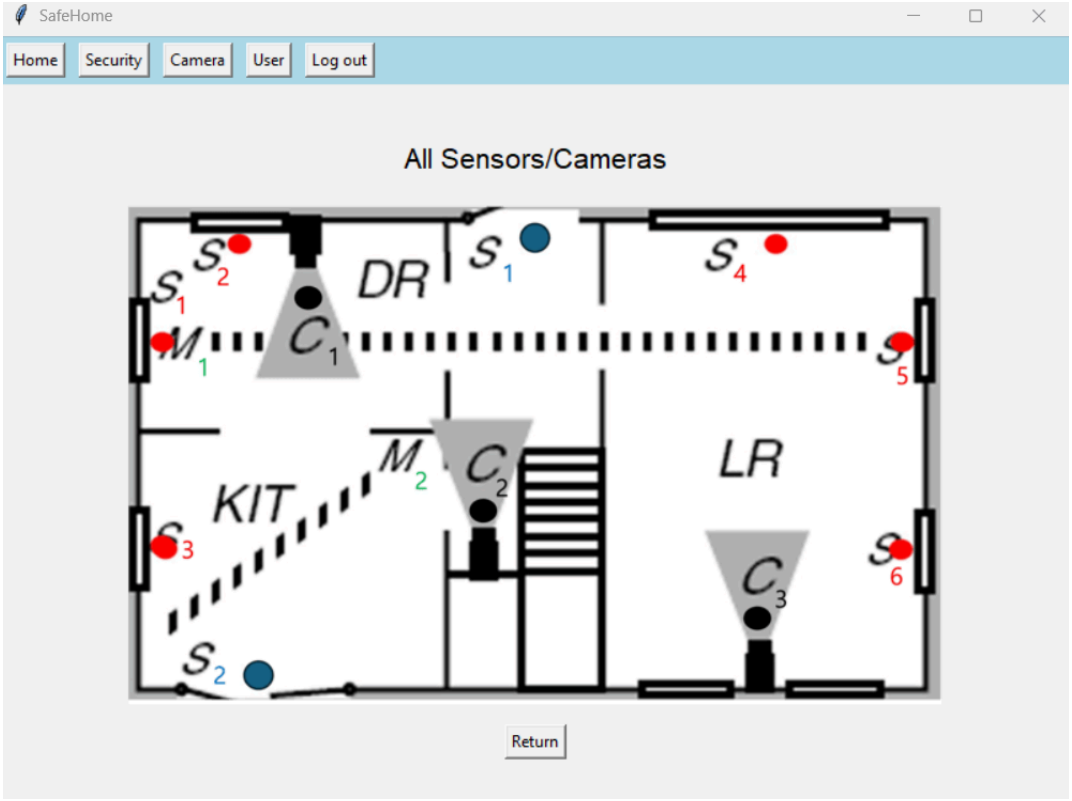


Key Features

- Buttons for accessing **All Sensors & Cameras**, **Safety Zone**, and **SafeHome Mode**
- Clear layout for quick access to essential security controls
- Return button to go back to the Home Page
- Organized navigation for efficient system management

v. All Sensors/Cameras Page

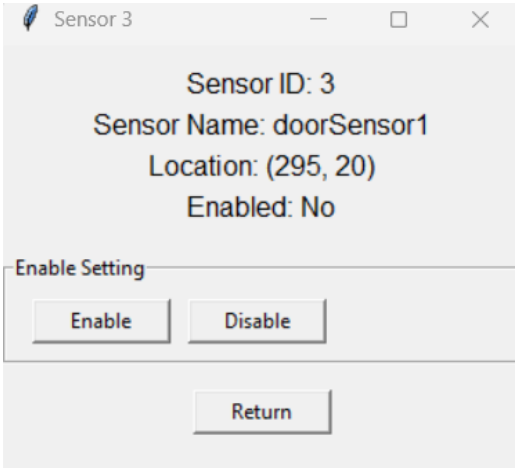
All Sensors/Cameras Page displays every sensor and camera on an interactive floorplan. Users can click any device icon to open its dedicated detail page—showing status and controls for sensors, or the full camera view page for cameras.



Key Features

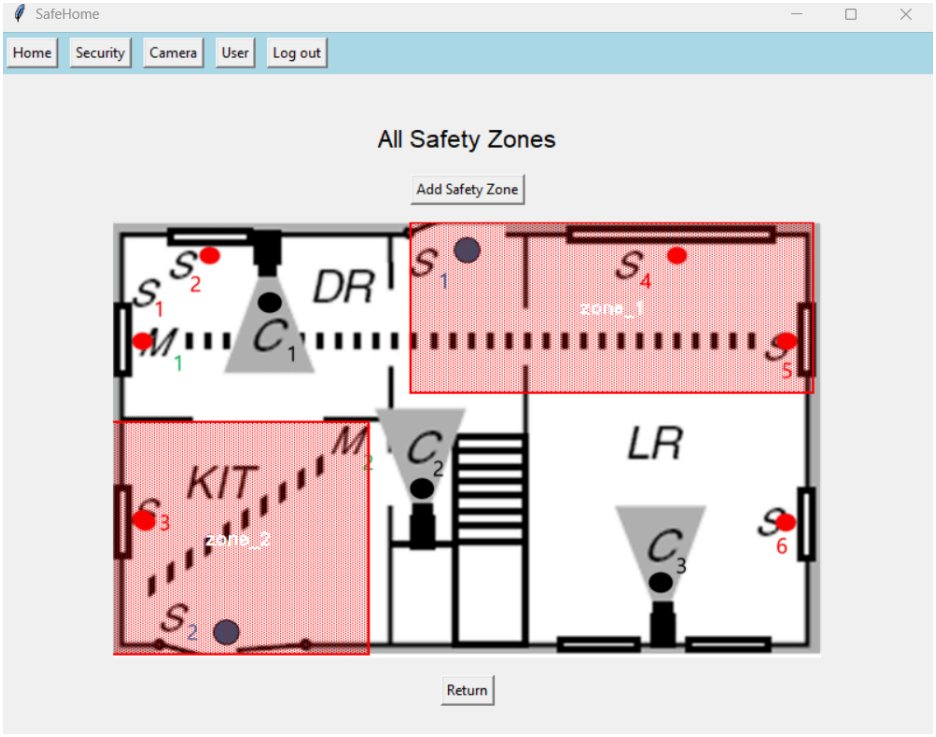
- Interactive floorplan showing all sensors and cameras
- Clickable device icons for quick access
- Sensor detail page with status display and enable/disable controls
- Camera detail page identical to the main Camera Page (view, status, zoom, pan)
- Clear visual layout for understanding device placement and system coverage

Sensor Detail Page



vi. Safety Zone Page

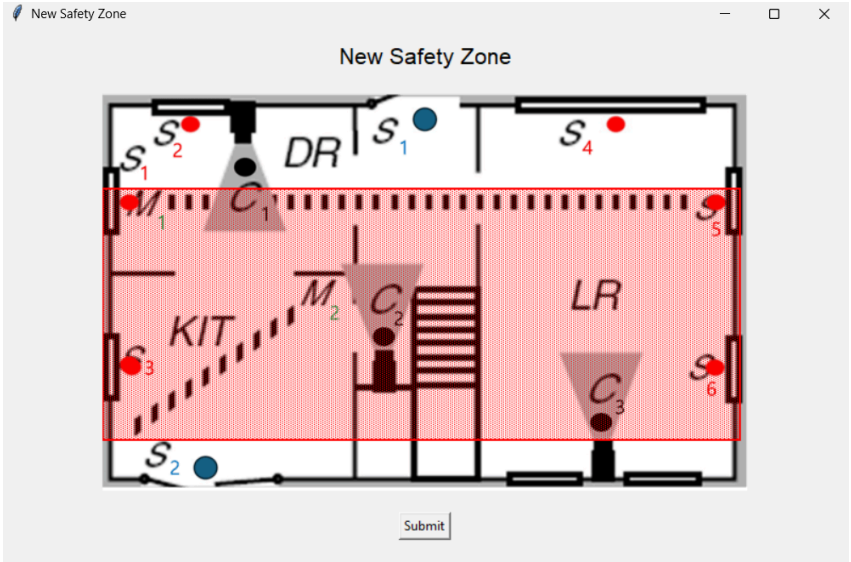
Safety Zone Page displays all safety zones on the floorplan and allows users to manage or create zones. Each zone can be selected directly from the floorplan to view its details, enable or disable all associated sensors, remove the zone, or adjust its configuration. A dedicated button lets users add new safety zones by selecting sensors on the floorplan.



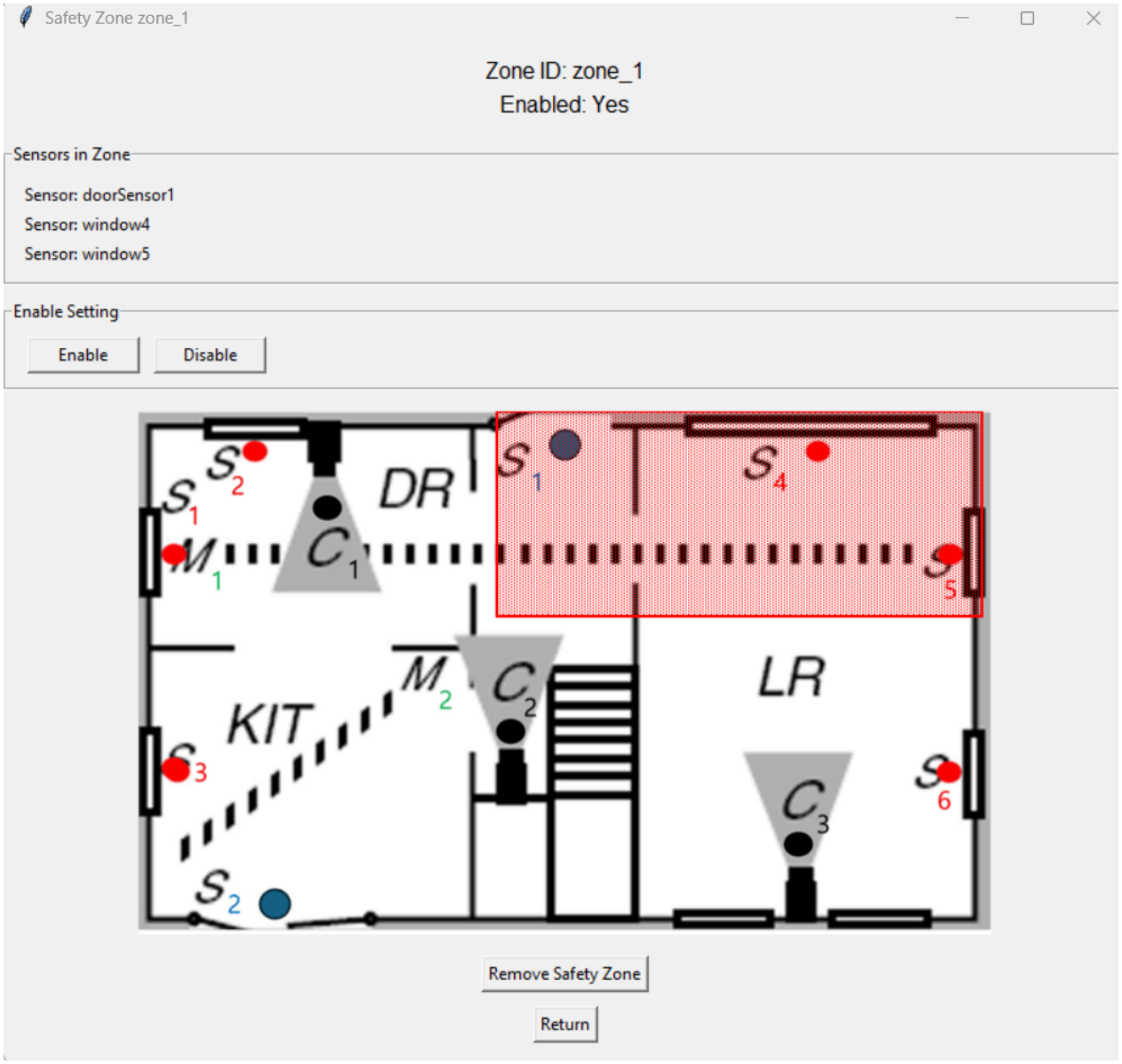
Key Features

- **Floorplan** showing all existing safety zones
- Clickable zones to open their detail page
- Zone detail page displaying zone information and sensor list
- Enable/disable all sensors in the selected zone
- **Remove Safety Zone** button for deleting a zone
- "**Add New Safety Zone**" button leading to a setup page with floorplan
- Ability to define a new zone by selecting sensors on the floorplan
- Clear visual layout for understanding zone coverage and configuration

Add New Safety Zone Page

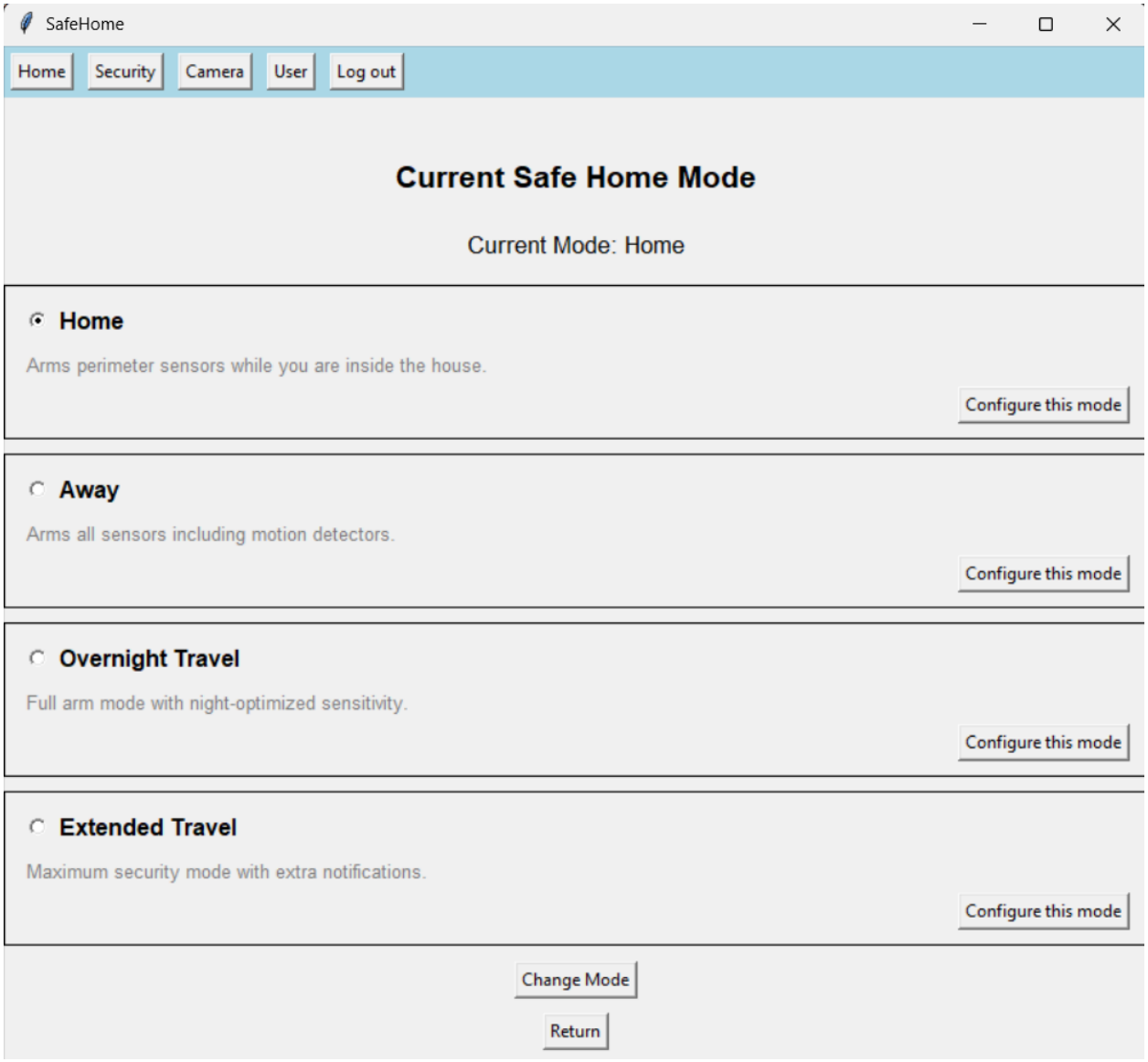


Safety Zone Detail Page



vii. SafeHome Mode Page

SafeHome Mode Page displays the current system mode and allows users to select or configure different modes. Each mode can be customized to include or exclude specific sensors, providing flexible security settings for various scenarios.

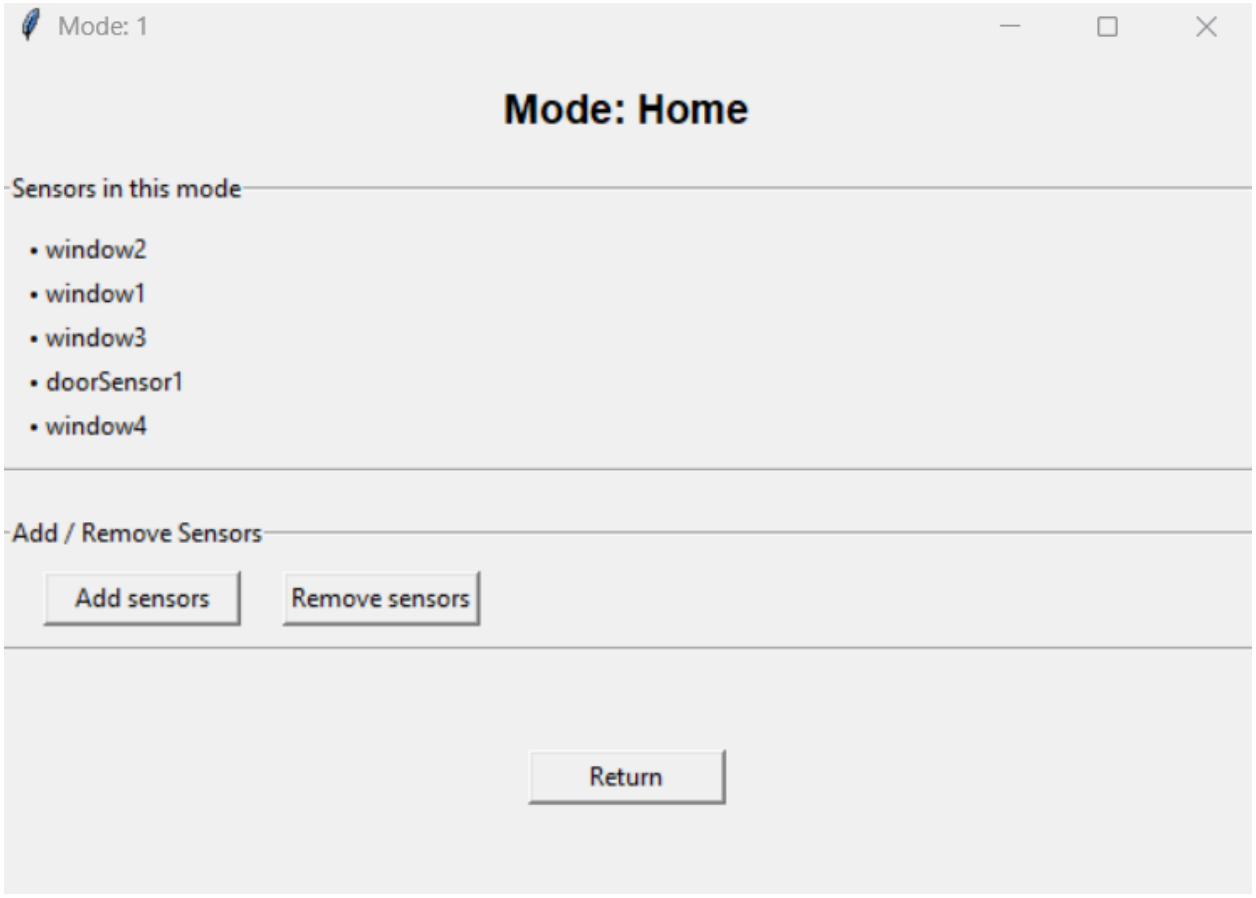


Key Features

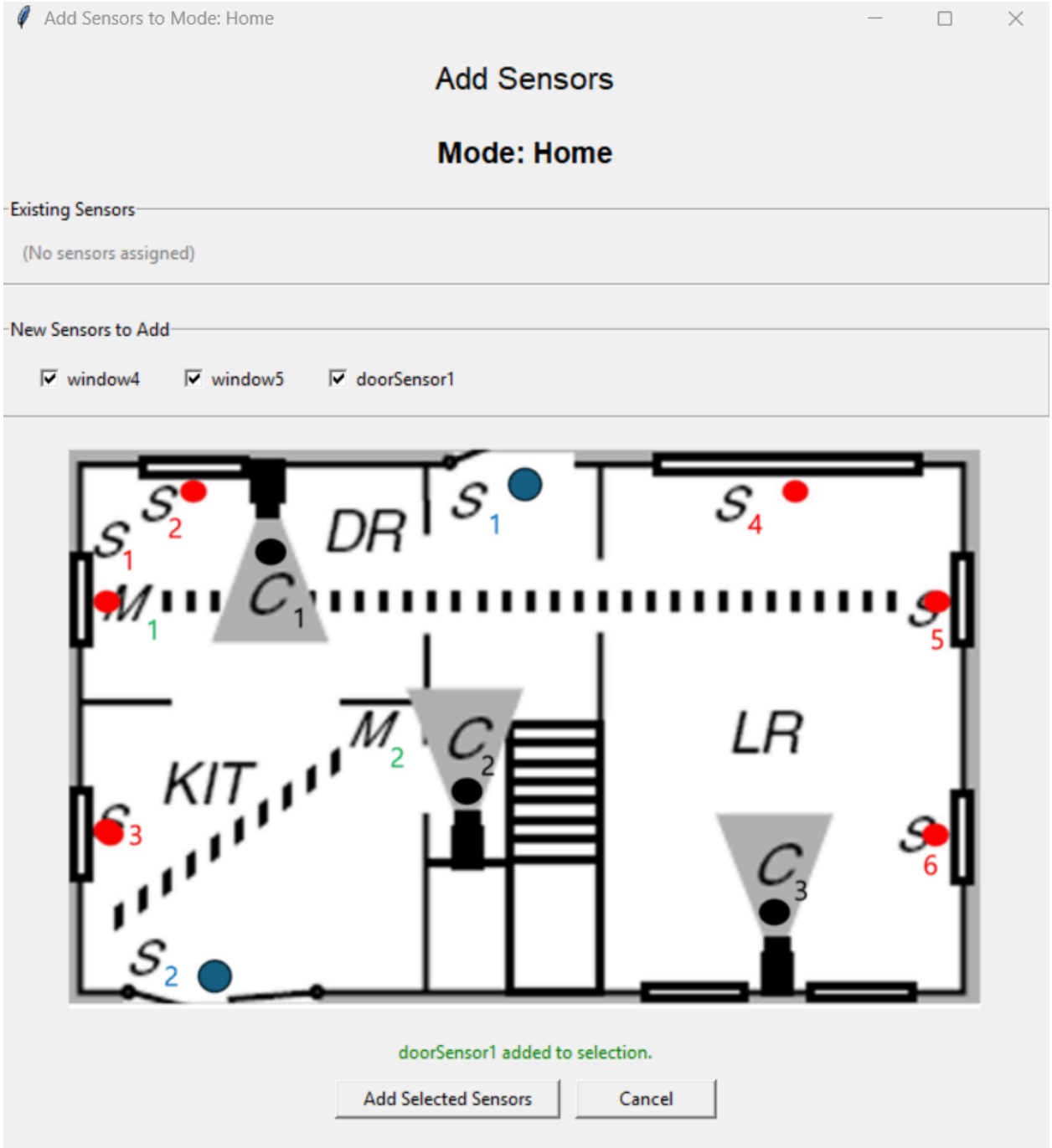
- Display of the current SafeHome mode
- Option to select a different mode
    - **Home** – Arms perimeter sensors while you are inside the house
    - **Away** – Arms all sensors including motion detectors
    - **Overnight Travel** – Full arm mode with night-optimized sensitivity
    - **Extended Travel** – Maximum security mode with extra notifications
- **“Configure this Mode”** button for each mode to access detailed settings
- Mode detail page showing included sensors with options to add or remove sensors
- **Add Sensor** opens a floorplan interface for selecting new sensors

- **Remove Sensor** displays all sensors with checkboxes to deselect and remove
  Flexible configuration for tailoring system behavior per mode

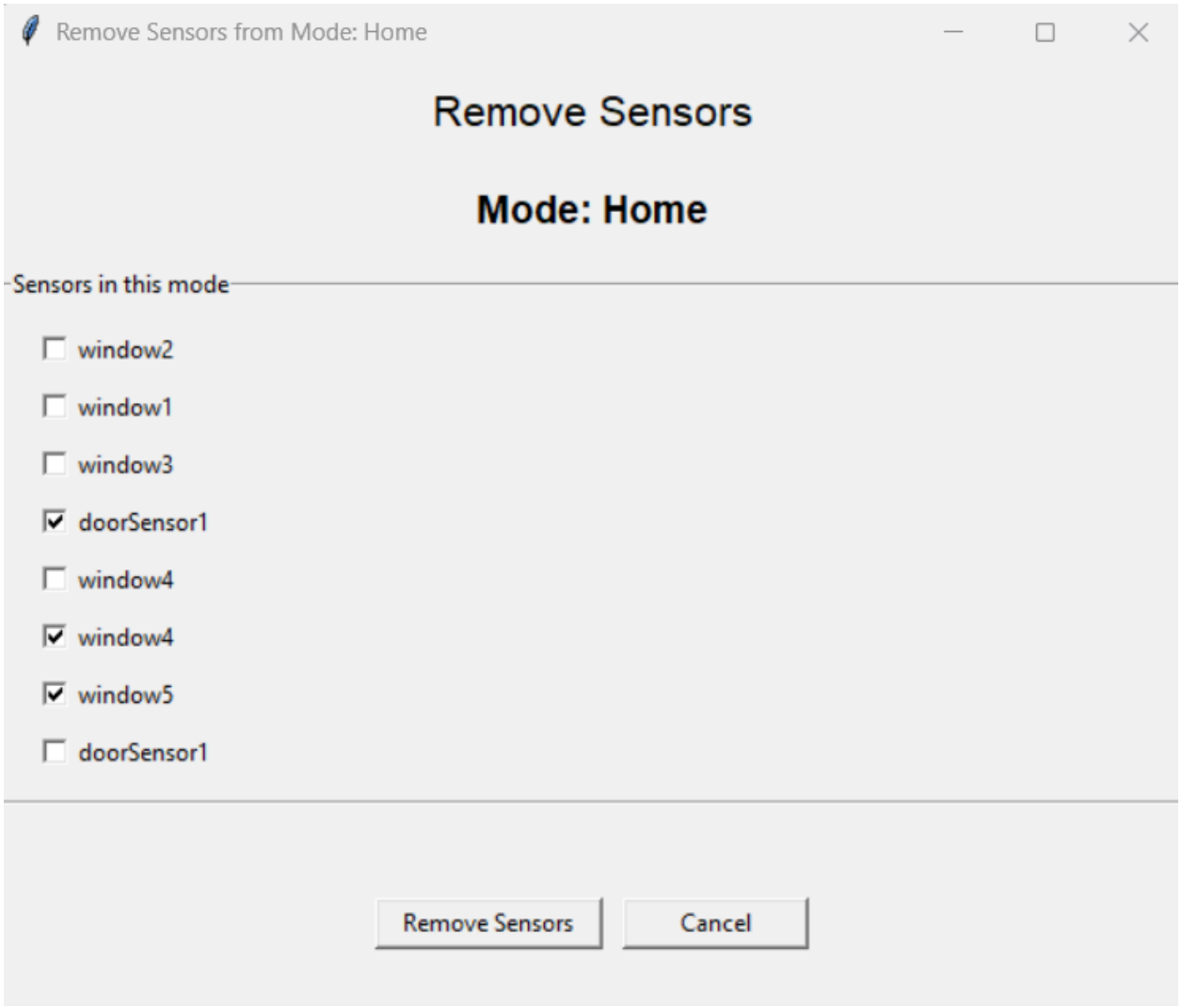
SafeHome Mode Configuration Page



SafeHome Mode Add Sensors Page

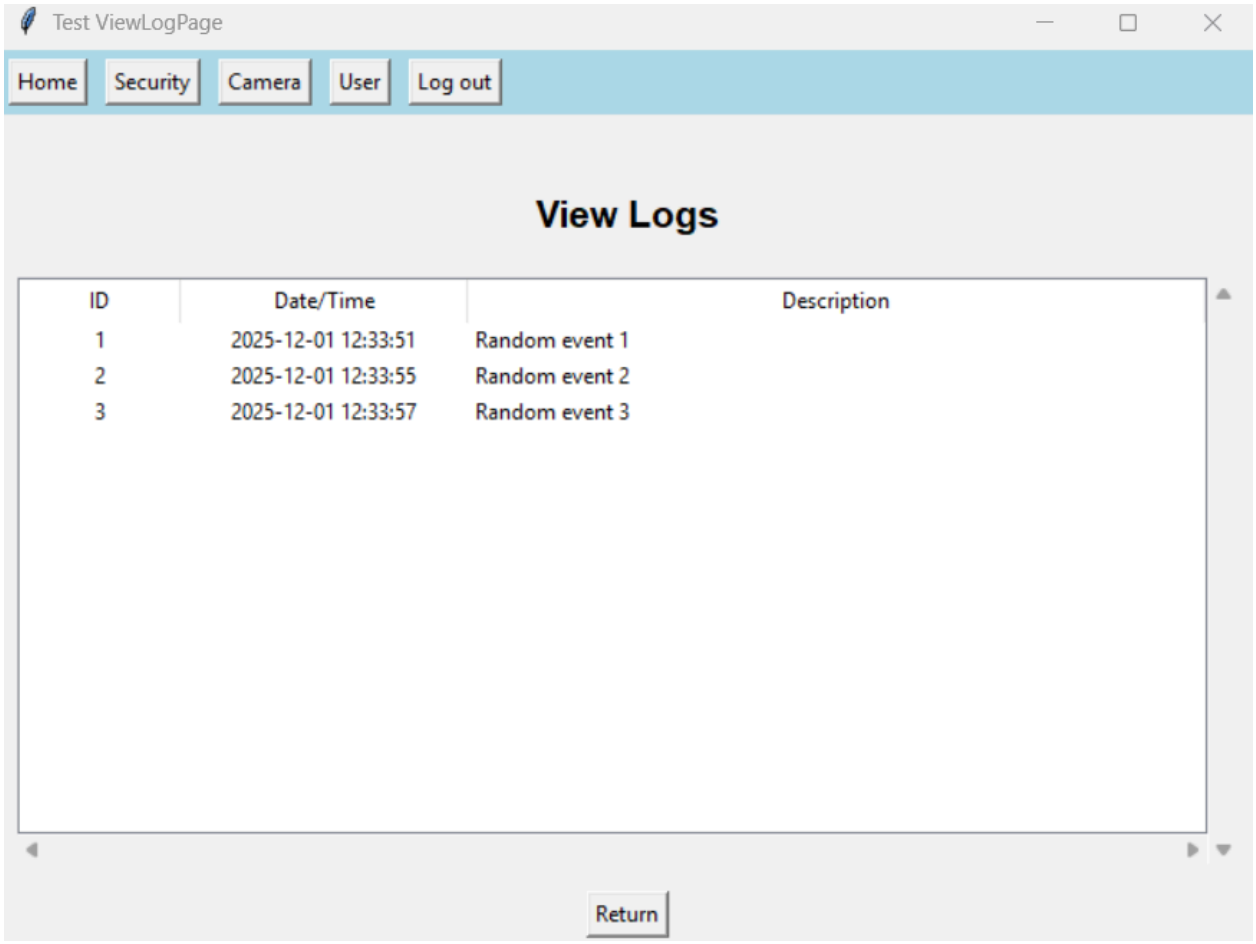


SafeHome Mode Remove Sensors Page



viii. View Log Page

View Log Page displays all security logs generated by sensors and system events. Users can review past activity, monitor alerts, and track changes in the system in a clear, organized table format.

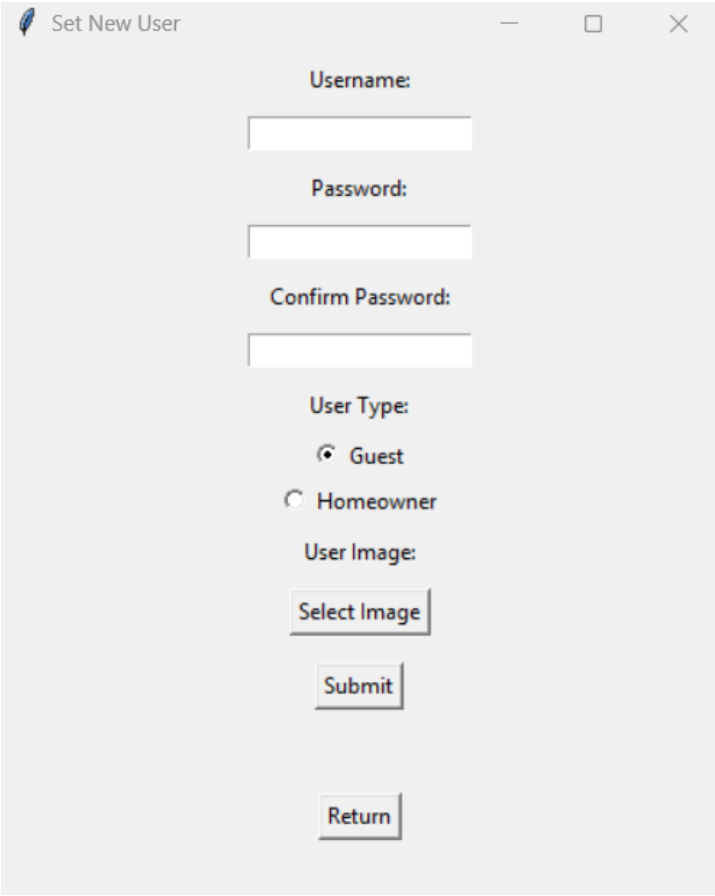


Key Features

- Display of all security logs with details such as date, time, and event description
- Organized table layout for easy reading
- Scrollable view for large numbers of logs
- Real-time updates when new events occur
- Quick navigation back to the Home Page

ix. Add User Page

Add User Page allows administrators to create new user accounts for the SafeHome system. Users can specify the account's name, password, and type, ensuring proper access control for homeowners and guests.



Key Features

- Form to enter **user name** and **password**
- Selection of user **type**: Homeowner or Guest
- Validation to prevent duplicate or invalid entries
- Easy submission to add the new user to the system
- Quick navigation back to the Home Page

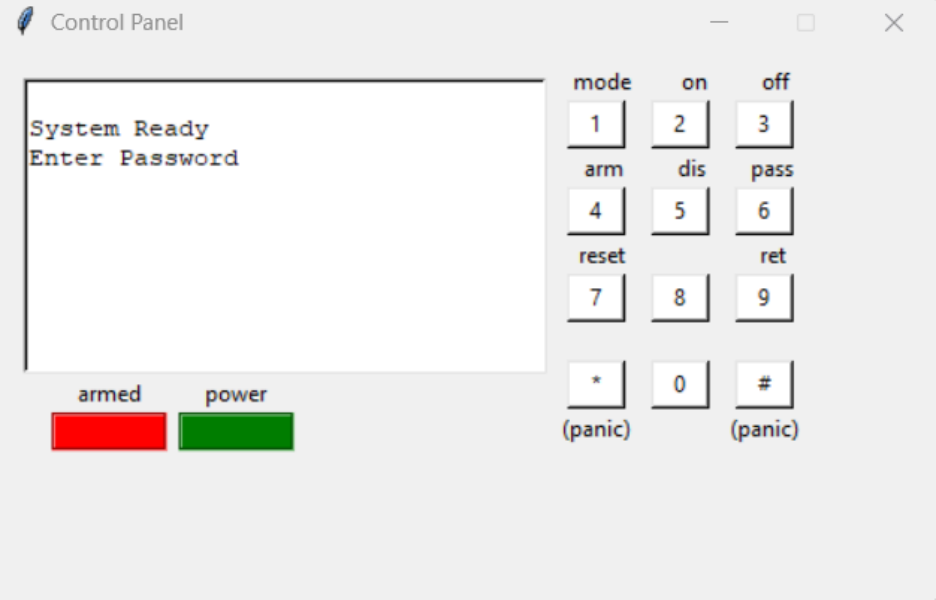
VI. How to Use SafeHome

A. About Control Panel

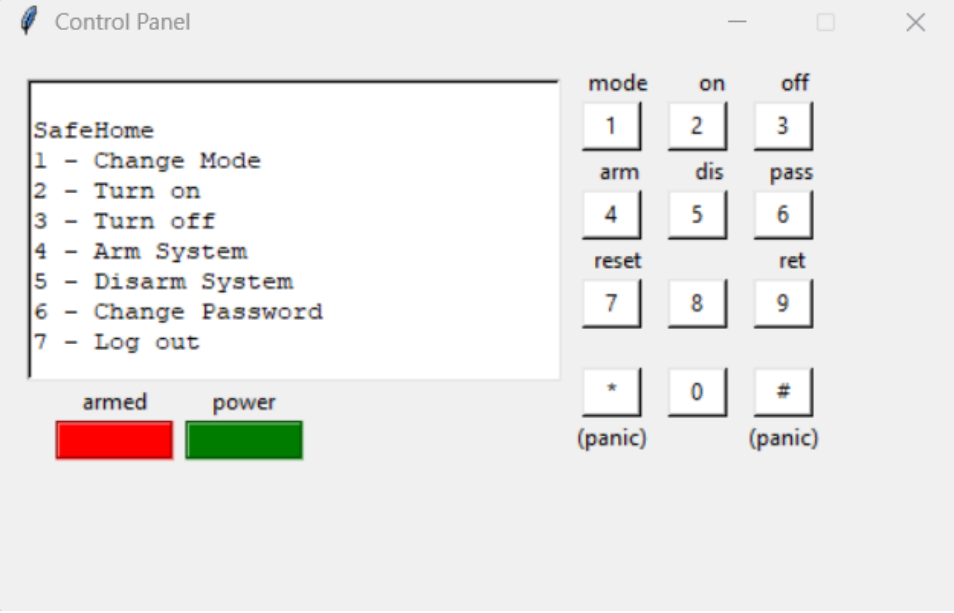
i. Log onto the system through control panel

Scenario:

1. The homeowner/guest enters master/guest password. (4 digits password)



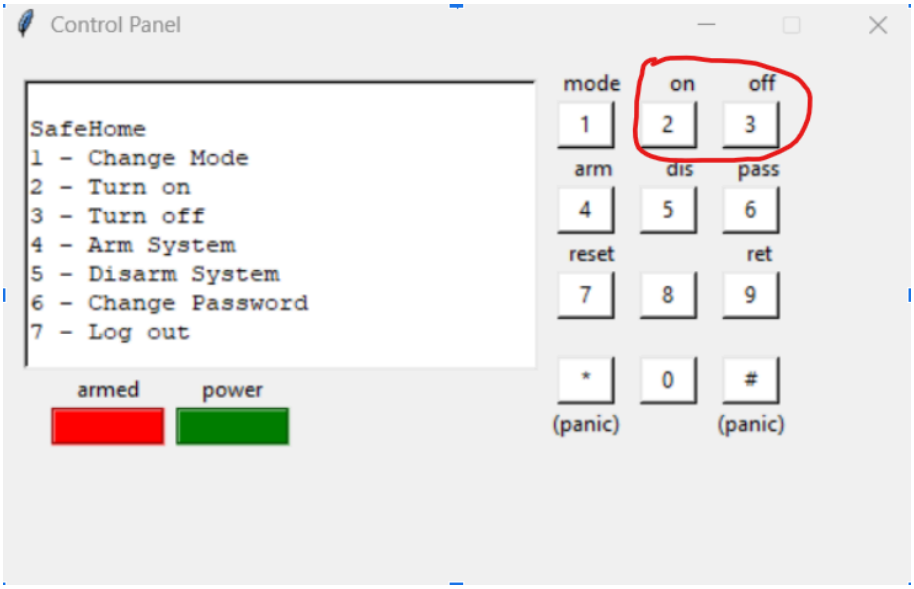
2. The system validates password.
3. The system shows accessible functions on the control panel.



ii. Turn the system on/off

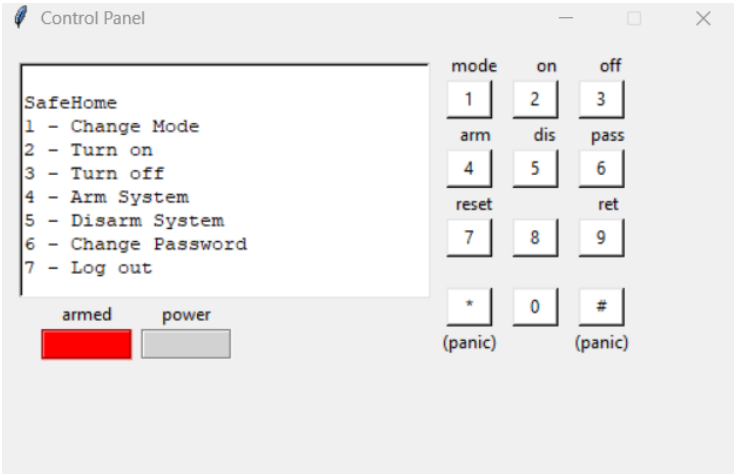
Scenario:

1. The homeowner log onto the system via control panel
2. The homeowner presses "On/Off" button by
    a. Press **button 2** for turning on
    b. Press **button 3** for turning off



3. The system turns on/off..
4. The **power led** response to input button
    a. Turn on – led goes green
    b. Turn off – led goes light grey

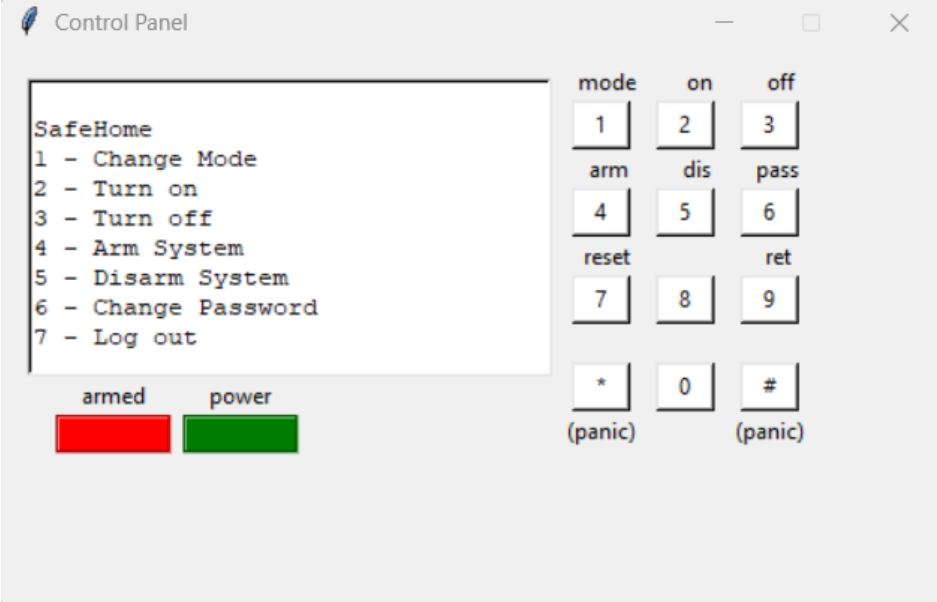
power led goes light grey after turn off



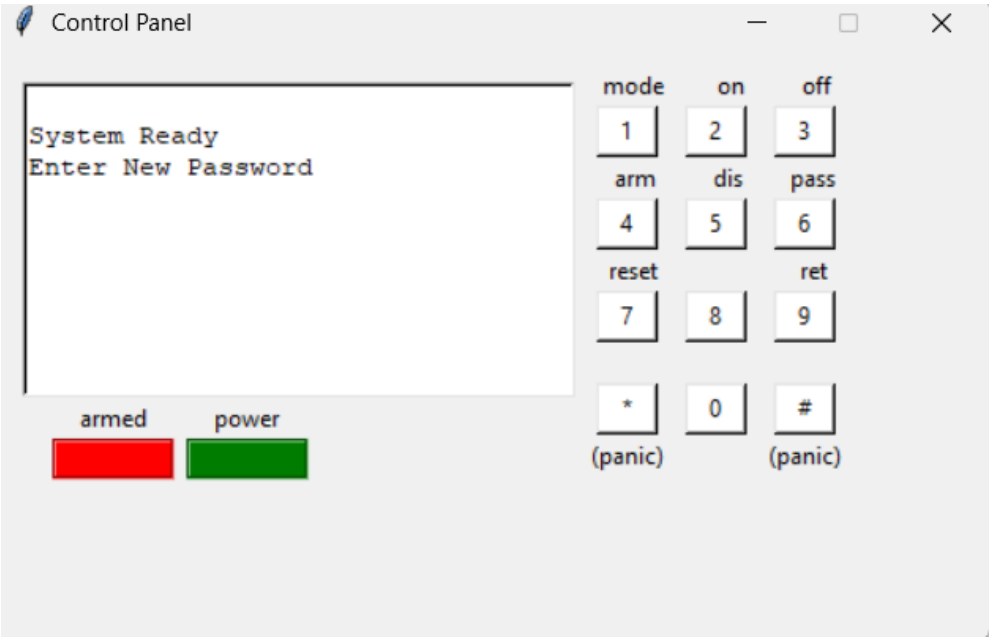
iii. Change master password through control panel

Scenario:

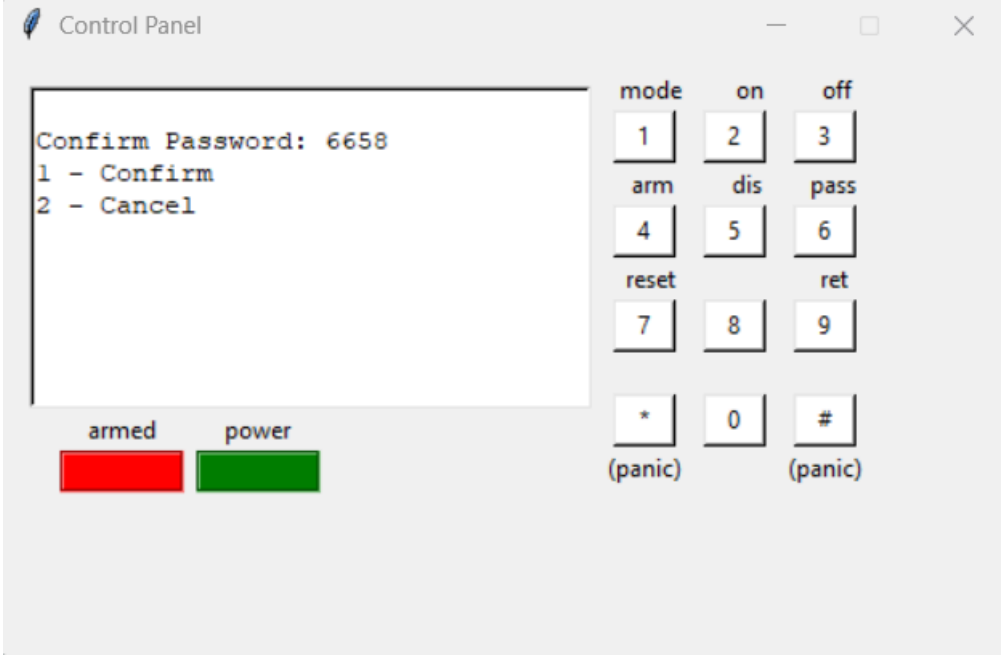
1. The homeowner log onto the system via control panel
2. The homeowner **button 6** to change the password.



3. The system asks for new password.
4. The homeowner enters new password.



5. The system asks to confirm new password again.

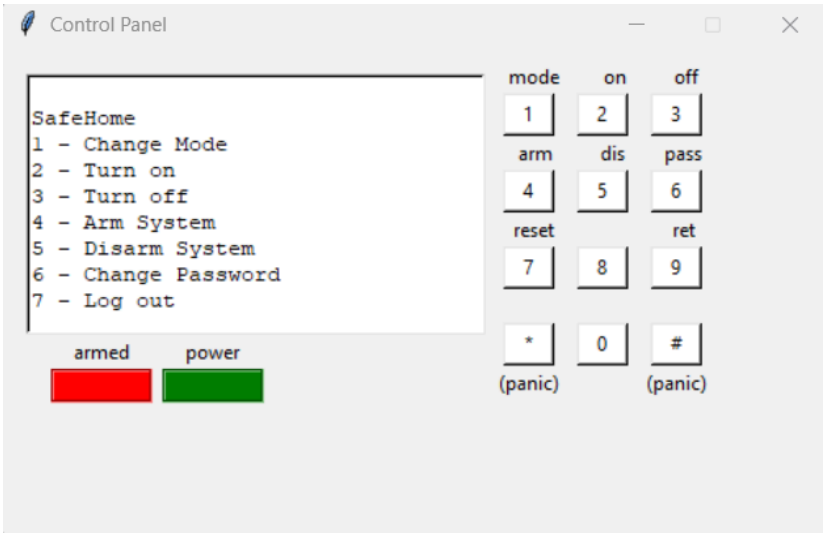


6. The homeowner press **button 1** to confirm new password / **button 2** to cancel changing password
7. The system changes the master password.

iv. Arm/disarm system through control panel

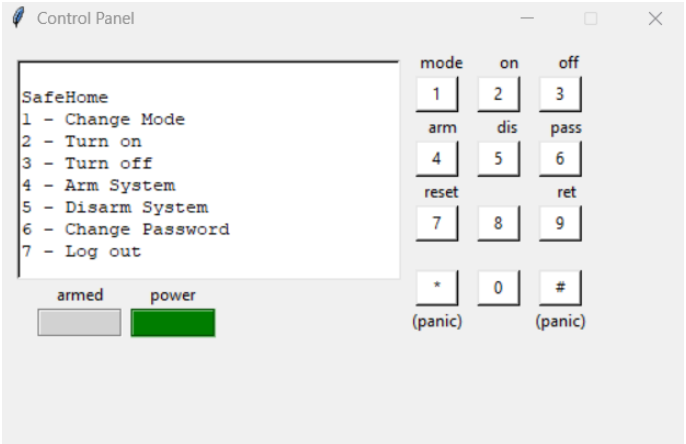
Scenario:

1. The homeowner log onto the system via control panel
2. The homeowner presses "Arm/Disarm" button by
    a. Press **button 4** for arming
    b. Press **button 5** for disarming



3. The system turns on/off..
4. The **armed led** response to input button
    a. Arm – led goes red
    b. Disarm – led goes light grey

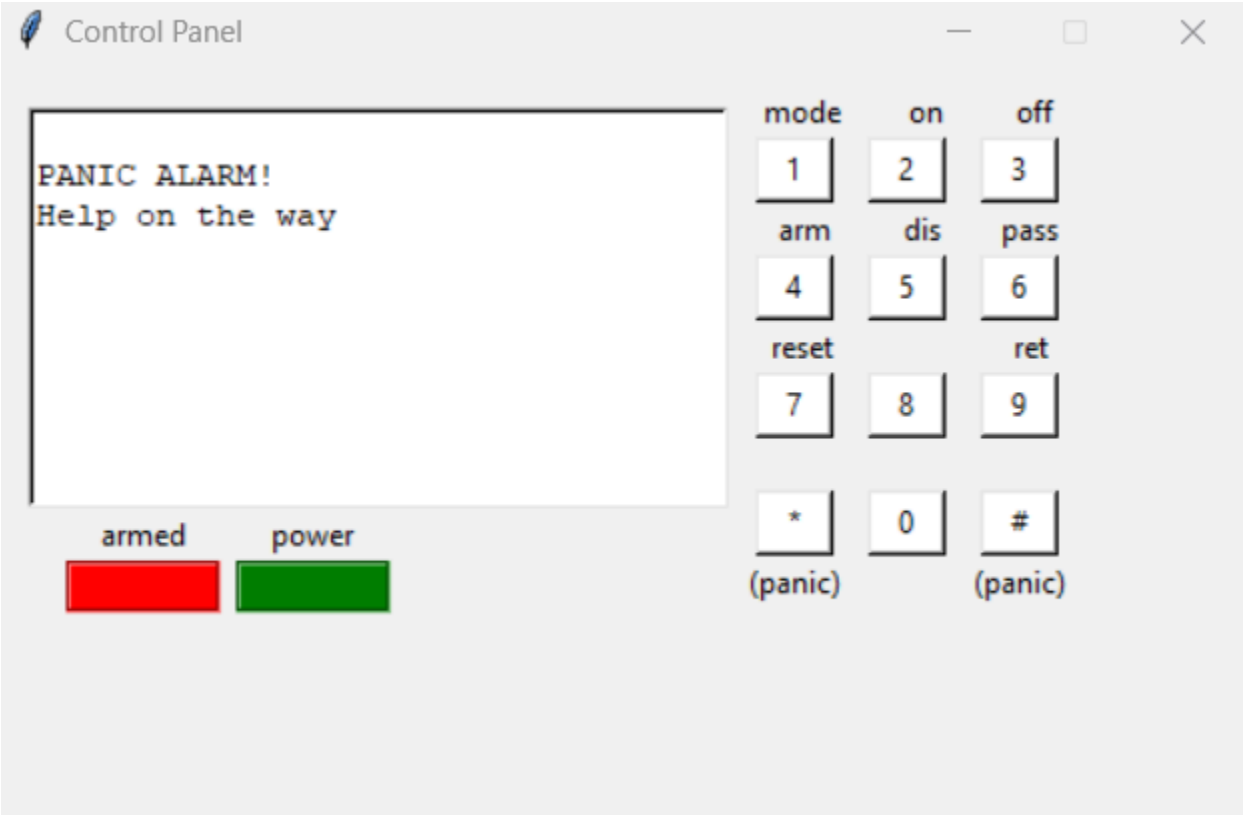
armed led goes light grey after disarm



v. Call monitoring service through control panel

Scenario:

1. The homeowner reaches the control panel on the system.
2. The homeowner presses **" * "** or **" # " button.**
3. The system calls the monitoring service immediately and reports panic condition.

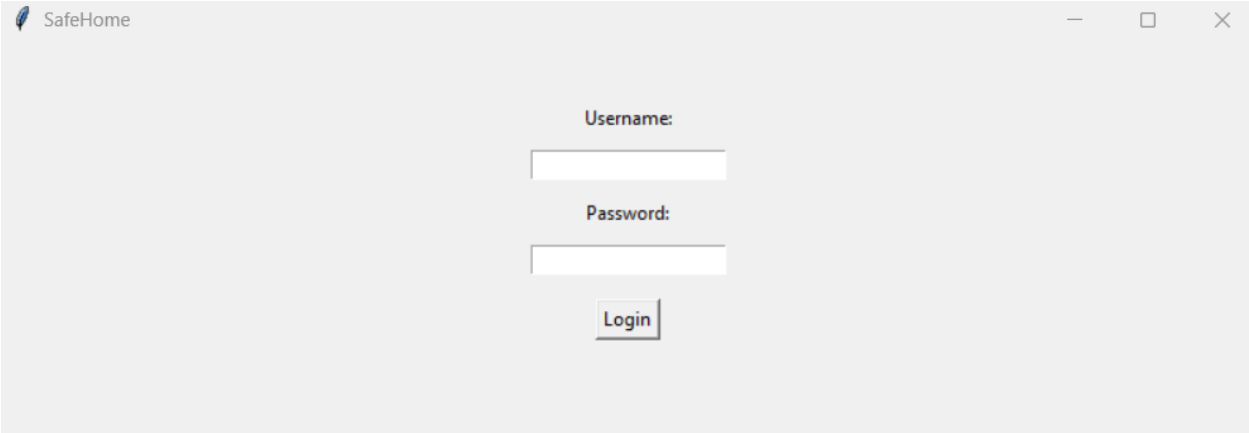


B. About Web Interface

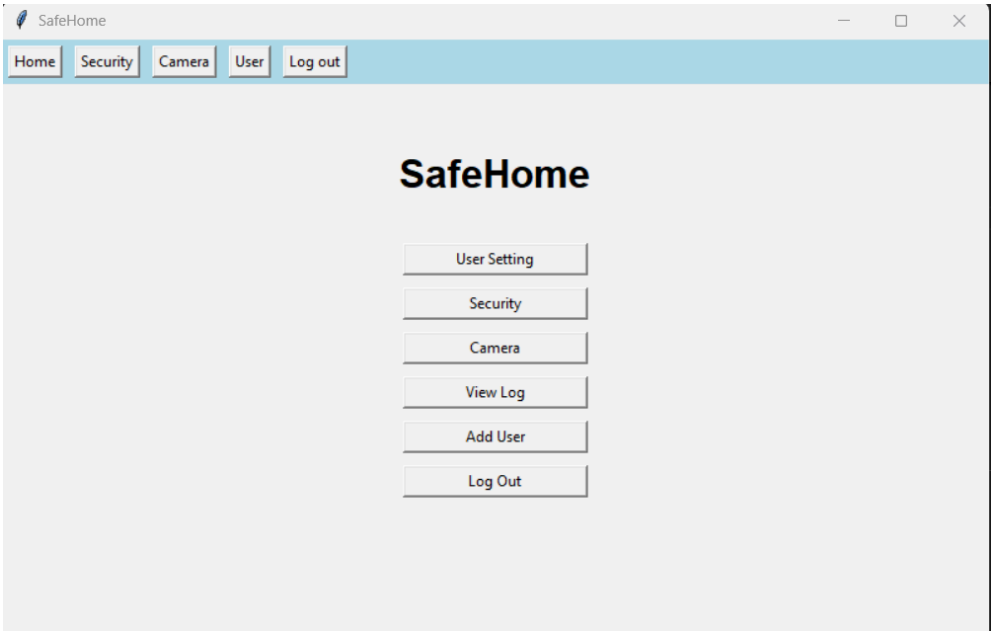
i. Log onto the system through web browser

Scenario:

1. The homeowner connects SafeHome web page.
2. The homeowner enters user ID.



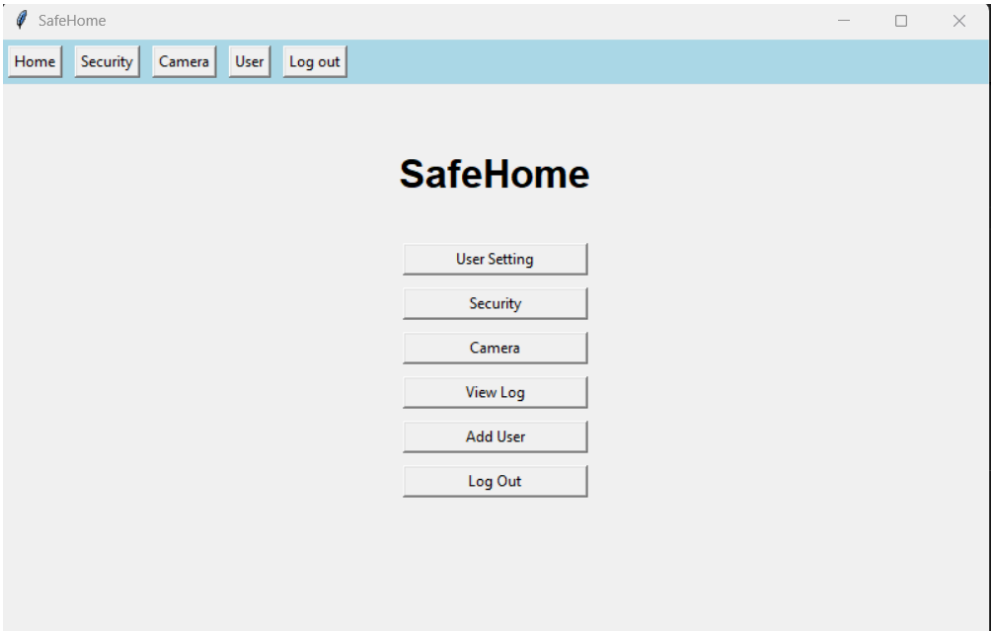
3. The system validates the password.
4. The system displays all major function buttons and home safety status.



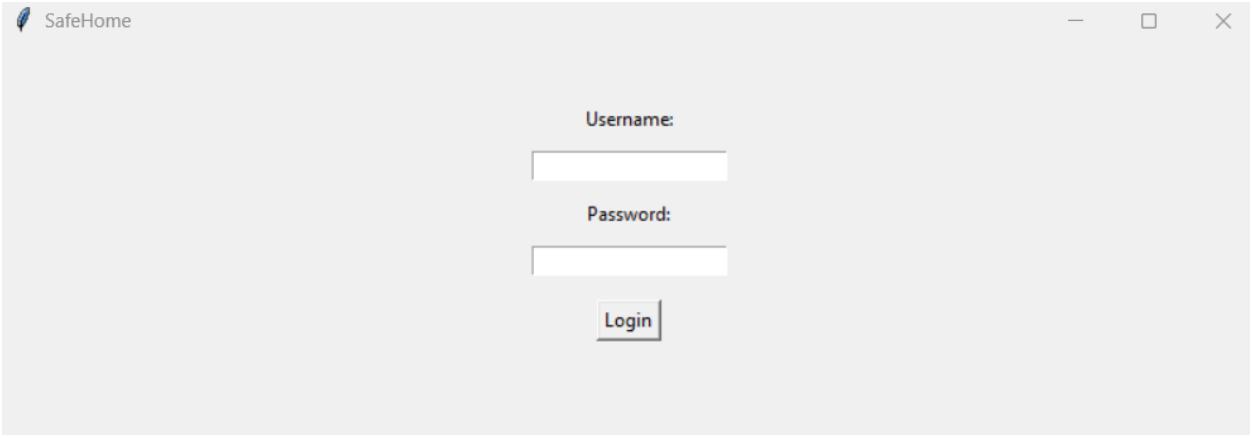
ii. Log out from the system through web browser

Scenario:

1. The homeowner connects SafeHome web page.
2. The homeowner press **logout button** on **header** / **home page**



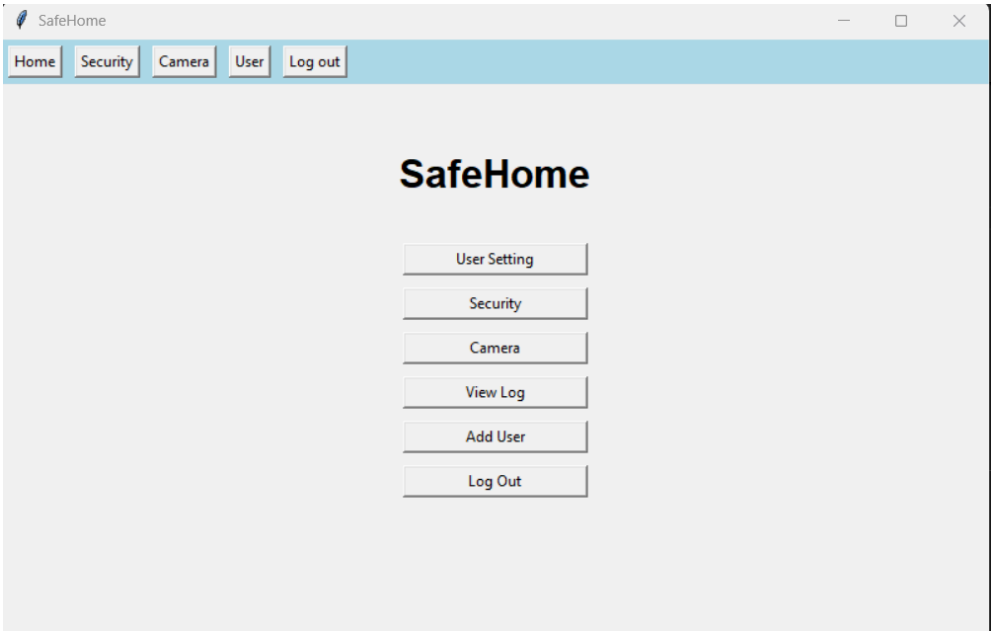
3. System goes back to **login page**



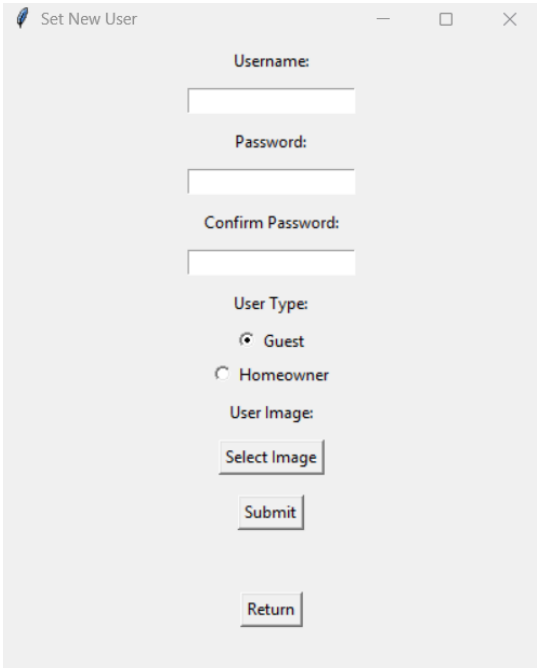
iii. Add User to the system

Scenario:

1. The homeowner enters user ID.
2. The homeowner enters two level passwords, each have 8 characters.
3. The homeowner press “**Add User” button** on **home page**



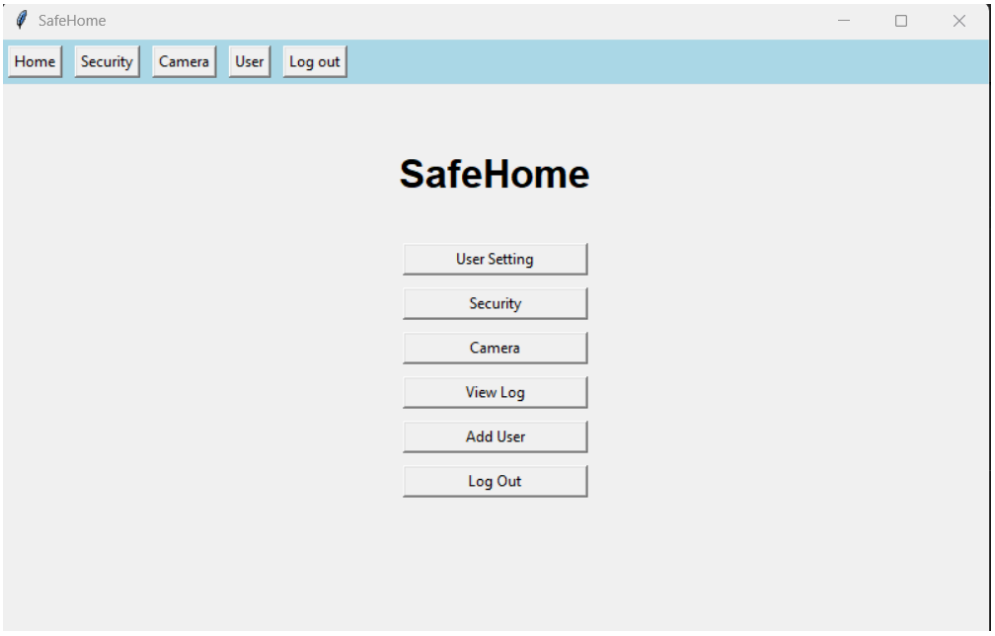
4. The homeowner enters new user information and presses the **submit button**.



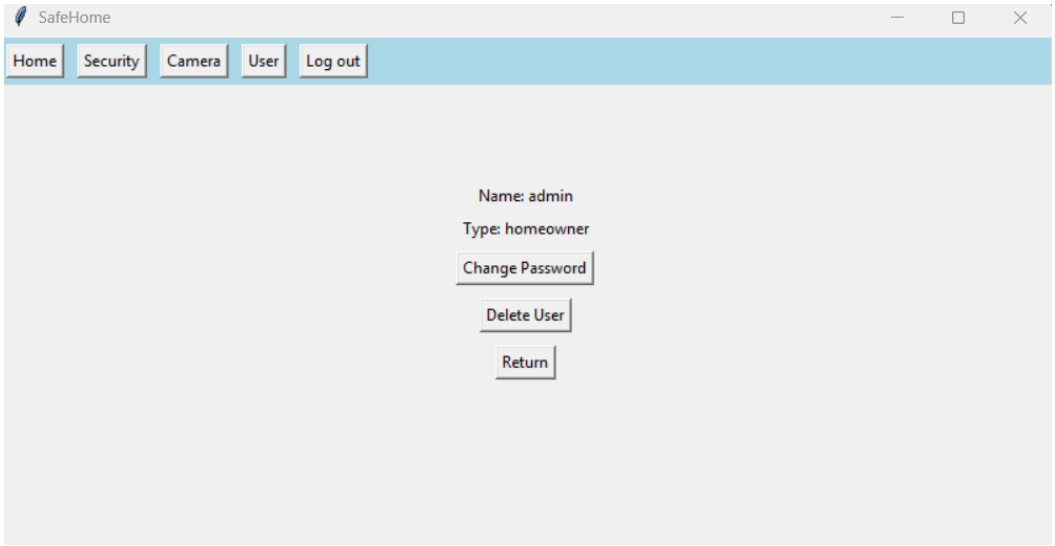
iv. Remove User from the system

Scenario:

1. The homeowner enters user ID.
2. The homeowner enters two level passwords, each have 8 characters.
3. The homeowner press “**Add User” button** on **home page**



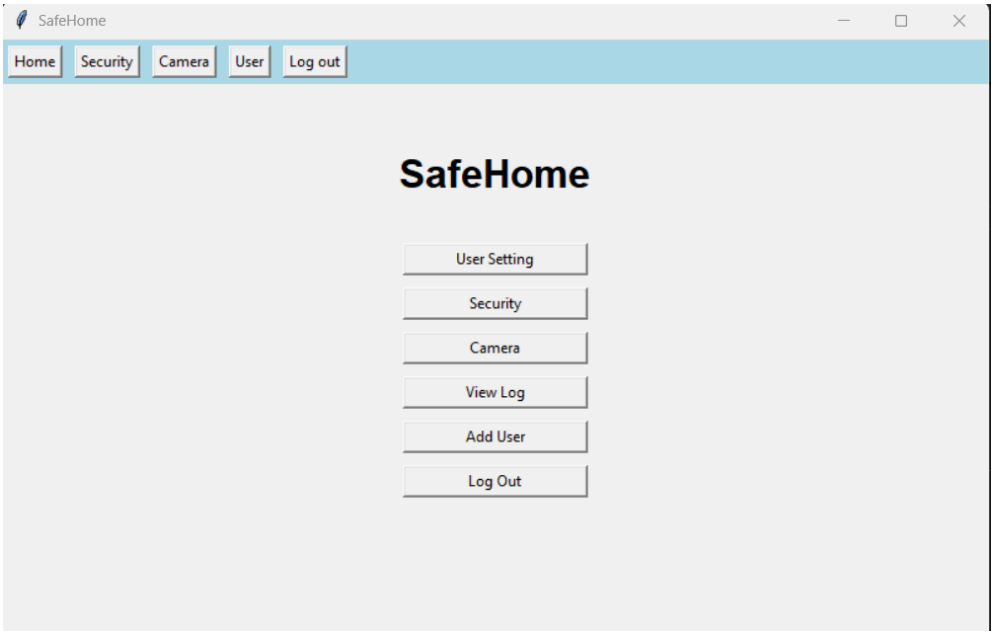
4. The homeowner presses the **delete user button** (first homeowner can not be removed from the system).



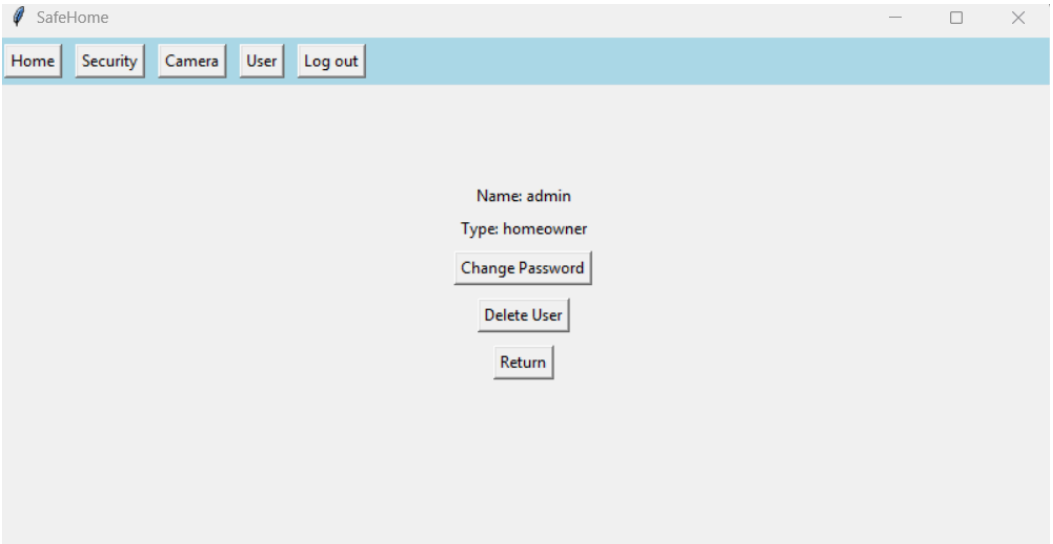
v. Change User Password

Scenario:

1. The homeowner enters user ID.
2. The homeowner enters two level passwords, each have 8 characters.
3. The homeowner press “**Add User” button** on **home page**



4. The homeowner presses the **change password button**

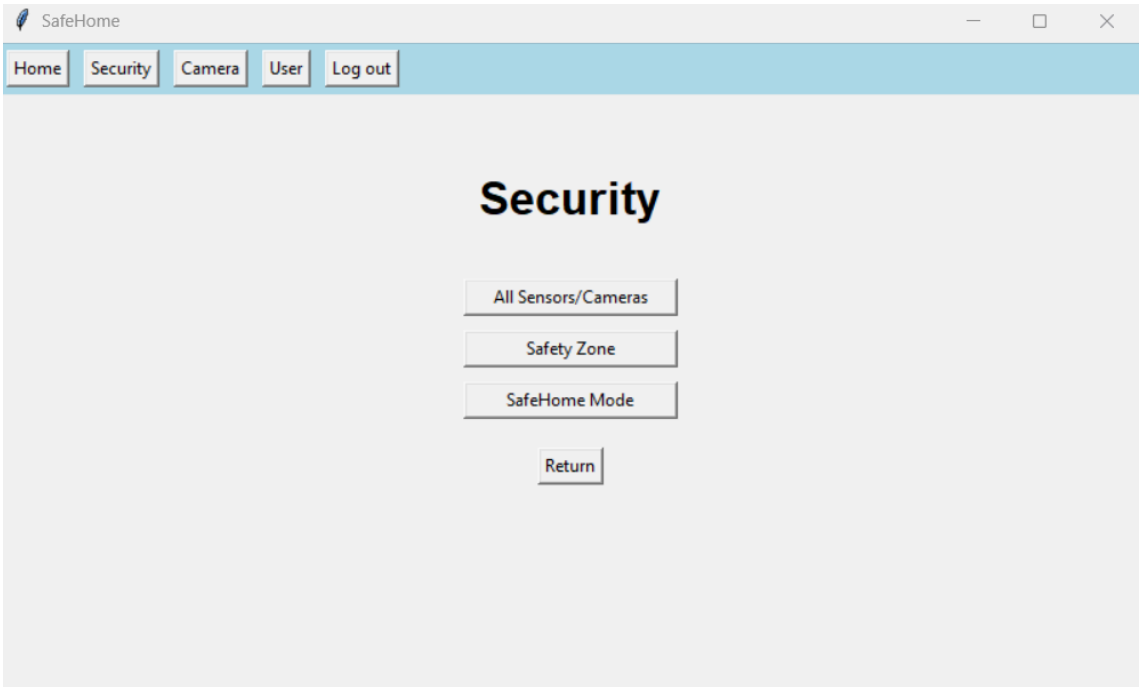


5. The homeowner enter new password and press **submit button**

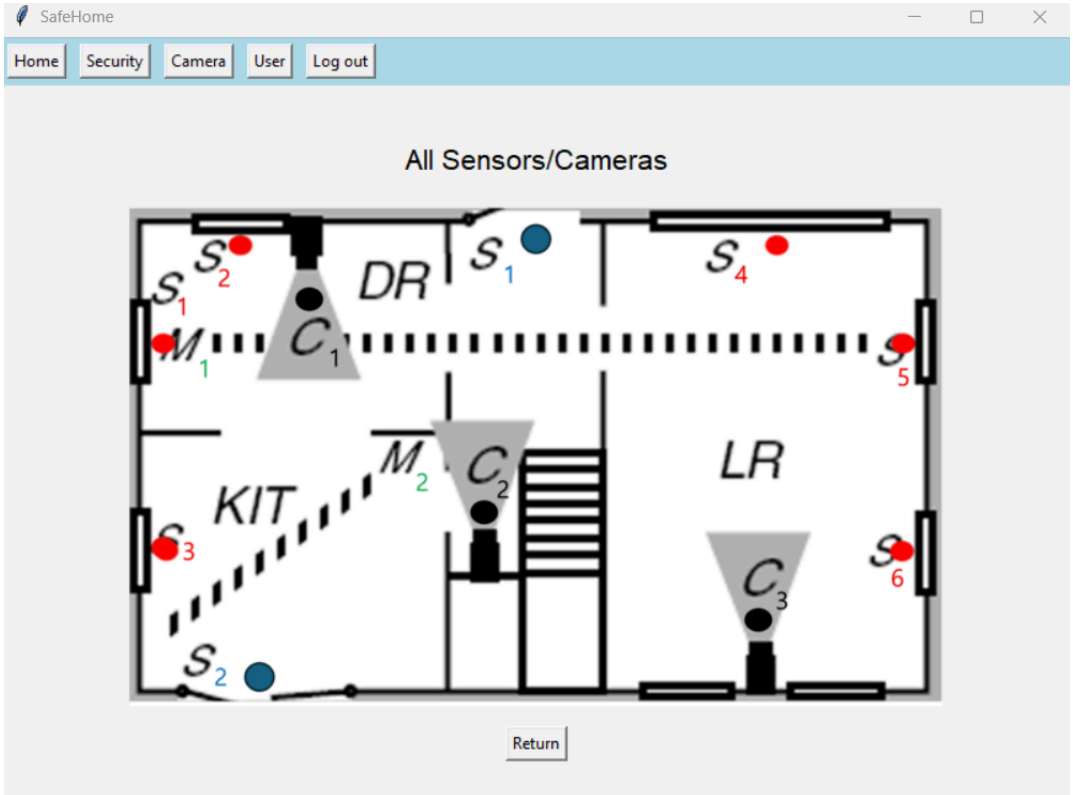
vi. Arm/disarm sensor through web browser

Scenario:

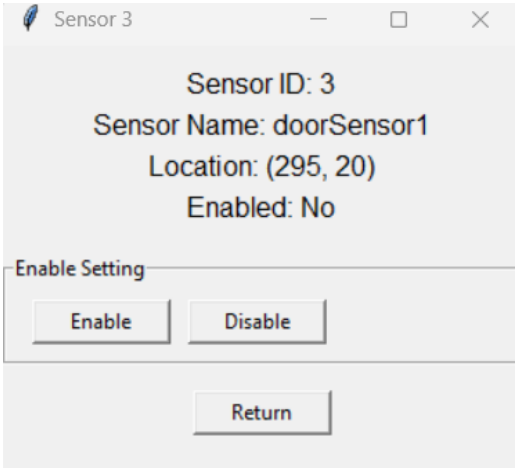
1. The homeowner logs onto the system through web browser.
2. The homeowner selects **"Security"button** on **home page**.
3. The homeowner selects "**All sensors/cameras**" from function buttons.



4. The system displays **floor plan view** with all sensors and cameras.



5. The homeowner selects sensor.

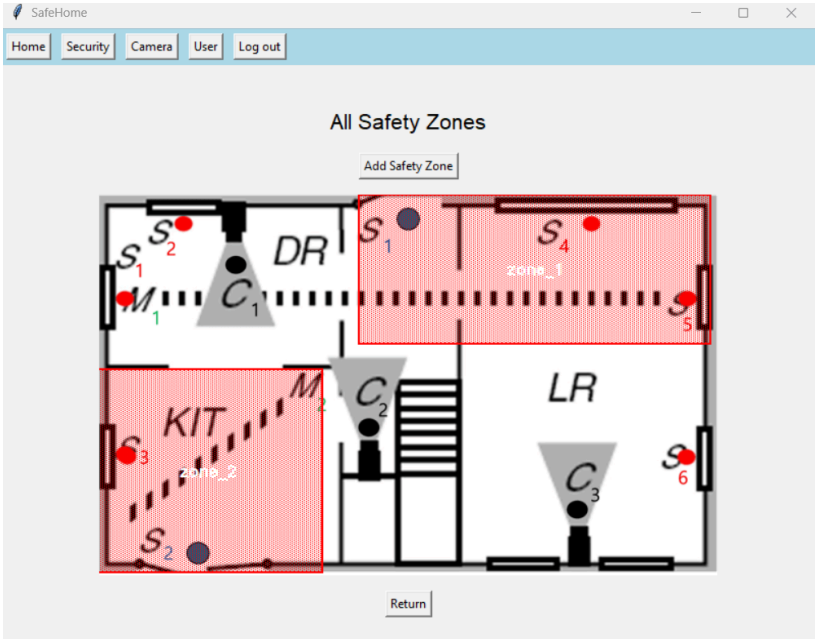


6. The homeowner presses **enable/disable button** to arm/disarm sensor.

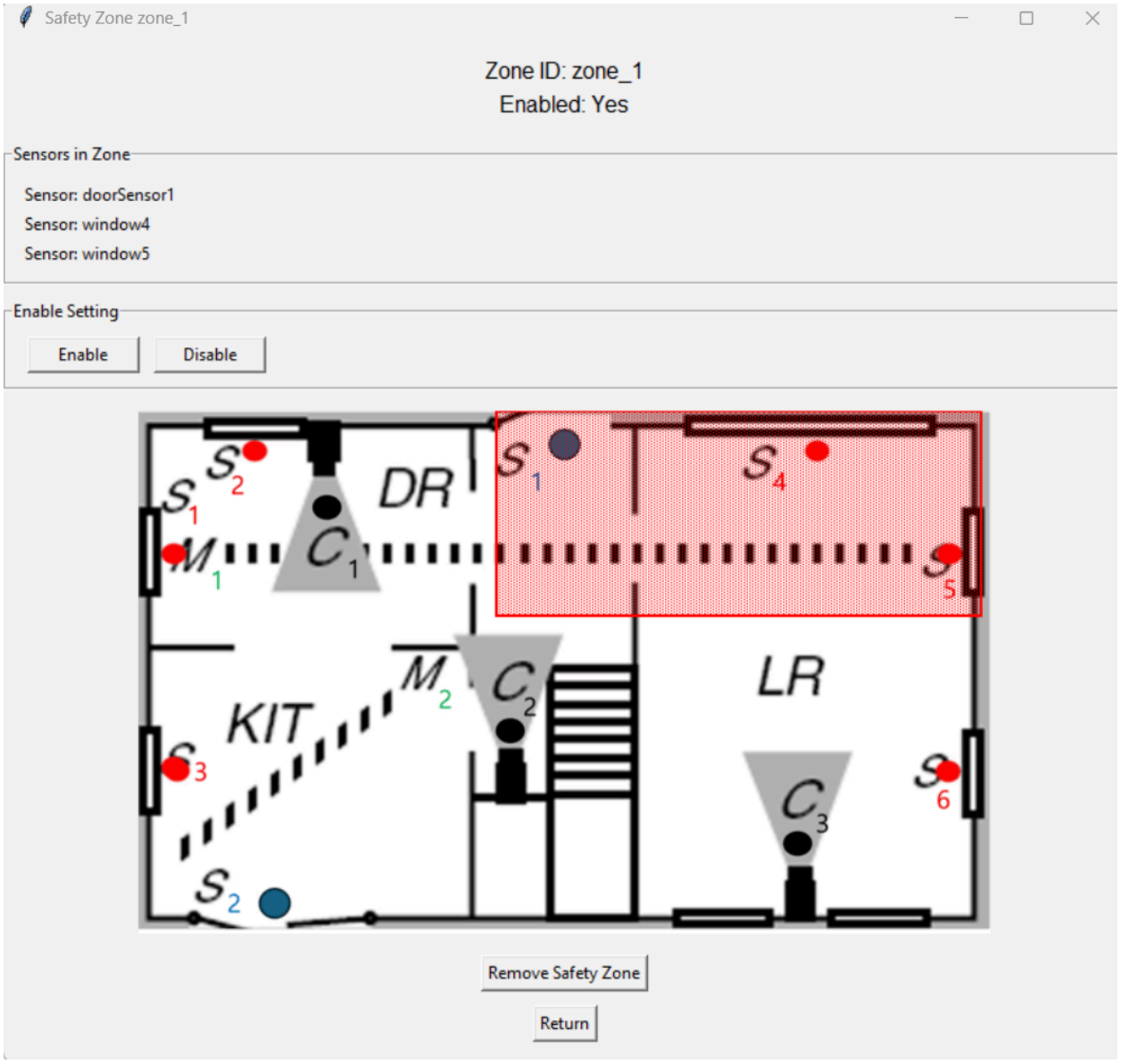
vii. Arm/disarm safety zone selectively

Scenario:

1. The homeowner logs onto the system through web browser.
2. The homeowner selects **"Security"button** on **home page**.
3. The homeowner selects "**Safety Zone"** from function buttons.
4. The system displays all safety zone on **floor plan view**.



5. The homeowner selects a safety zone on the floor plan and press **enable/disable button**.

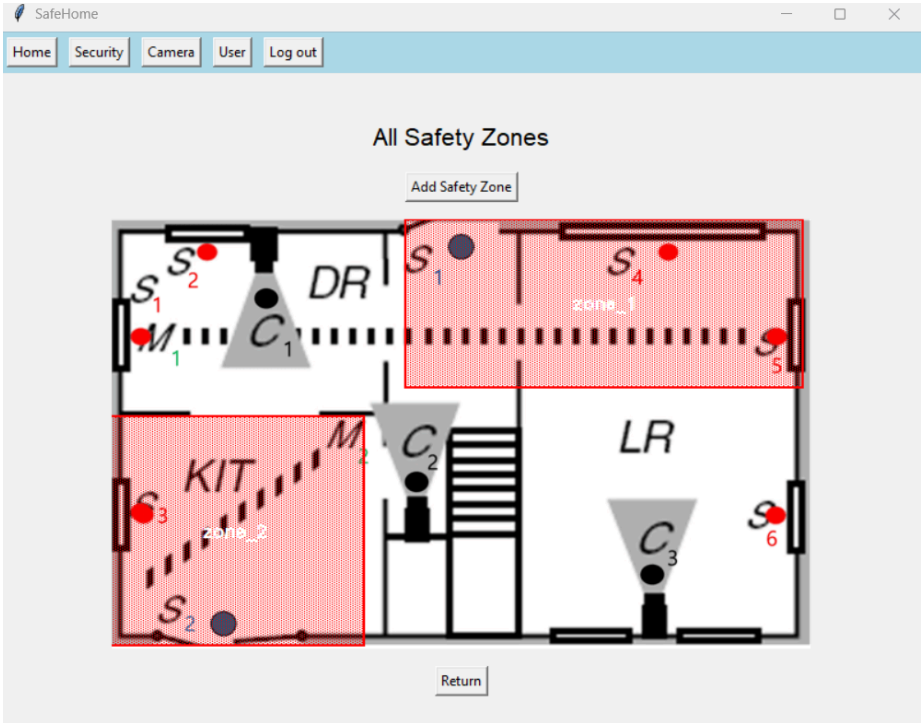


6. The system arms/disarms selected safety zone.

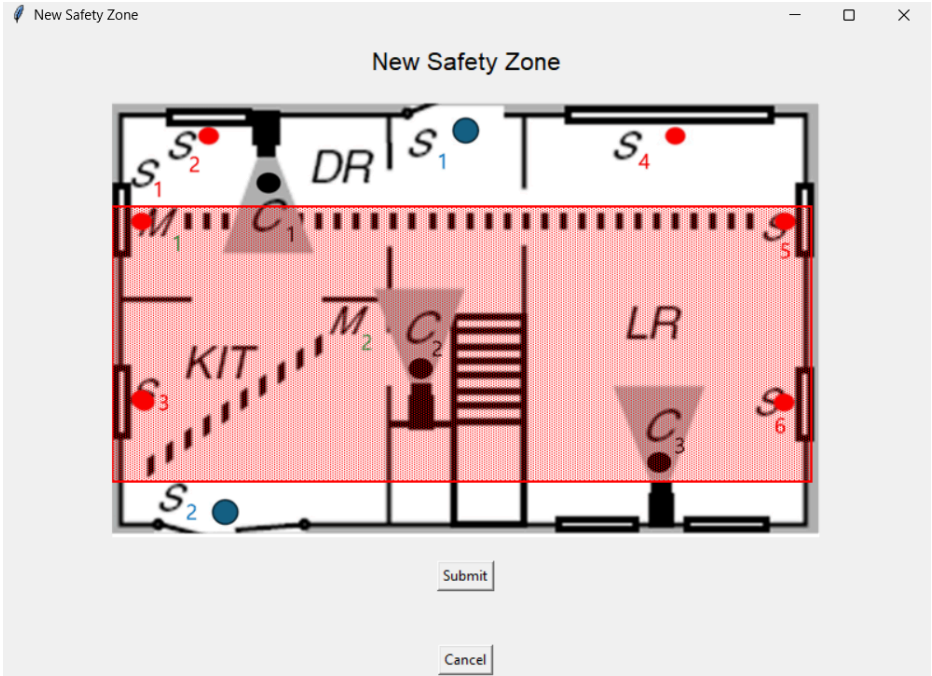
viii. Create new safety zone

Scenario:

7. The homeowner logs onto the system through web browser.
8. The homeowner selects **"Security"button** on **home page**.
9. The homeowner selects "**Safety Zone"** from function buttons.
10. The system displays all safety zone on **floor plan view**.



11. The homeowner press **“Add Safety Zone” button** and selects sensors for new safety zone
12. The homeowner presses **submit button** to register new safety zone

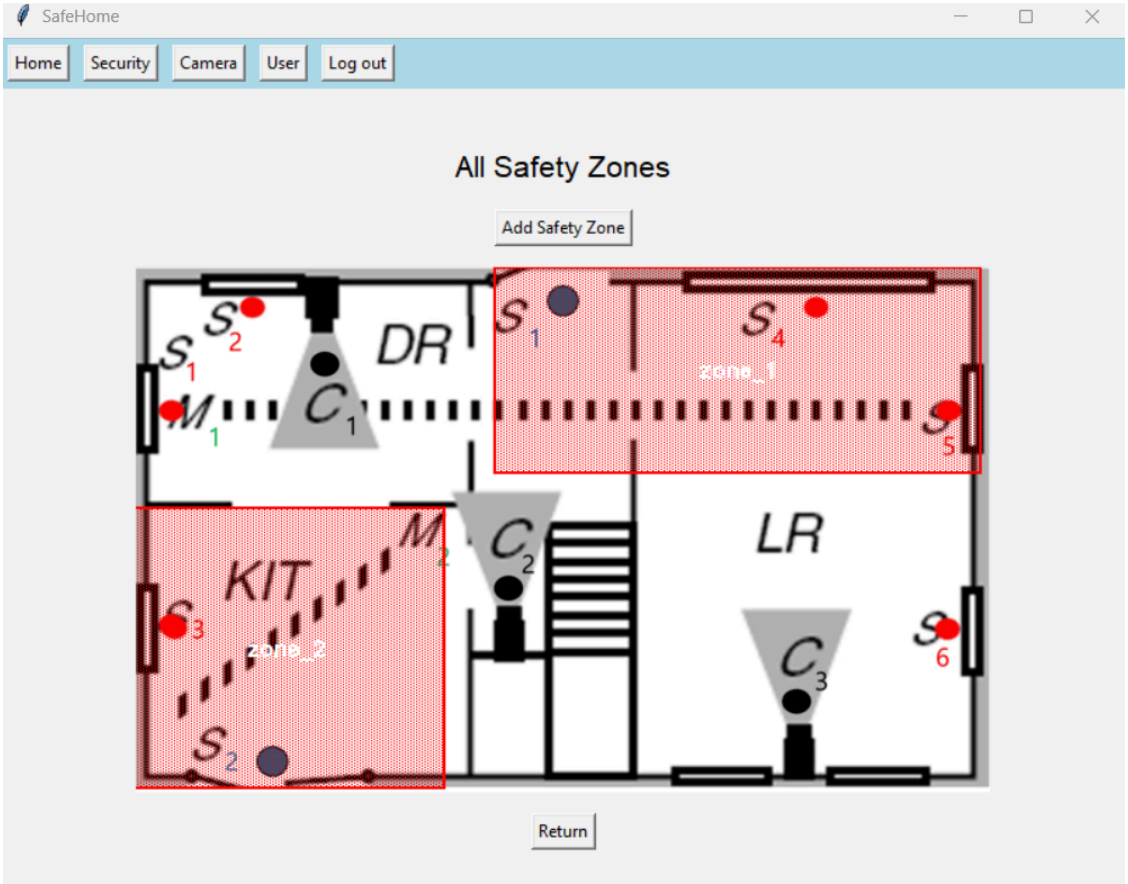


ix. Delete safety zone

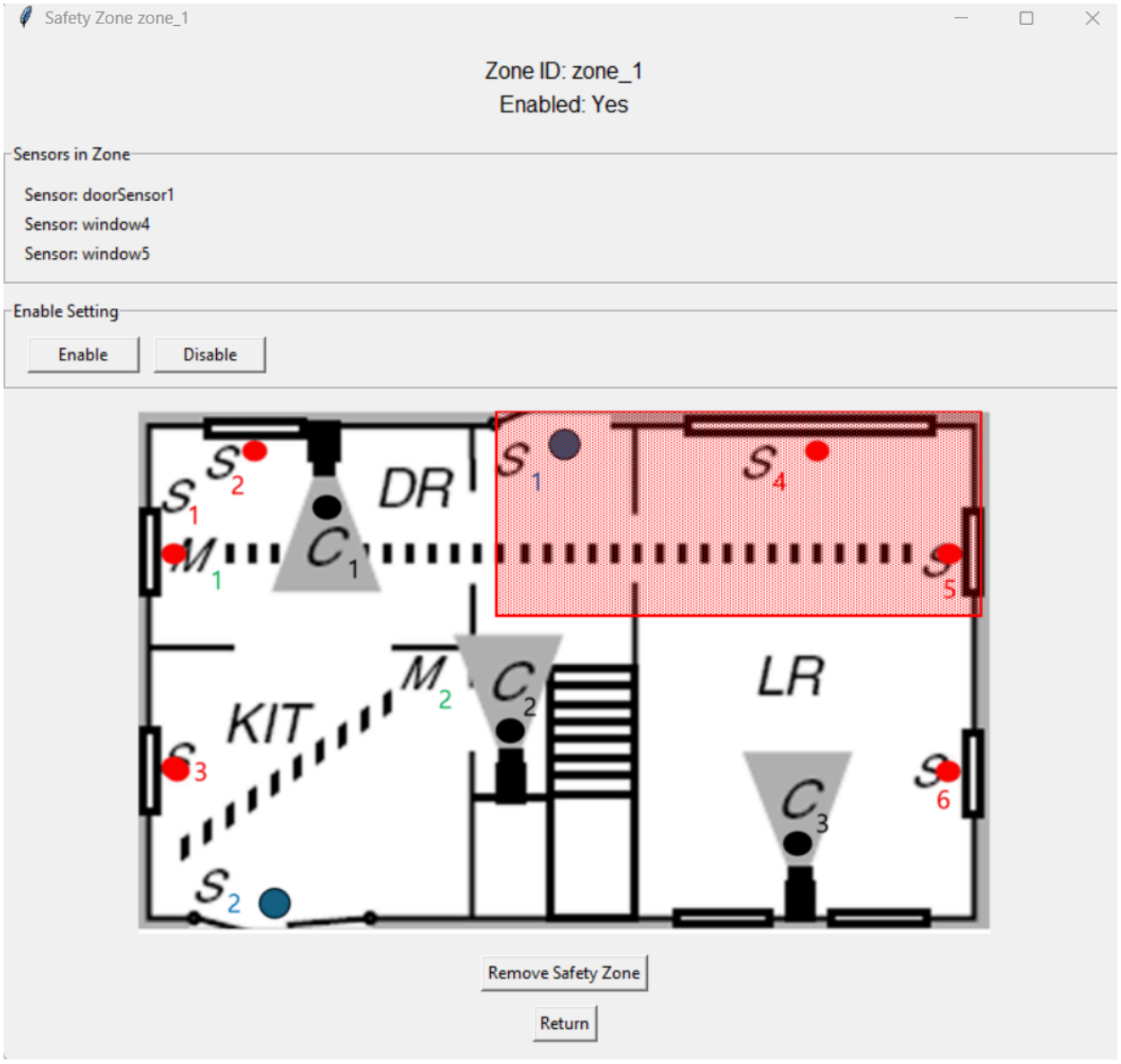
Scenario:

Scenario:

13. The homeowner logs onto the system through web browser.
14. The homeowner selects **"Security"button** on **home page**.
15. The homeowner selects "**Safety Zone"** from function buttons.
16. The system displays all safety zone on **floor plan view**.



17. The homeowner selects a safety zone on the floor plan and press **Remove Safety Zone button**.

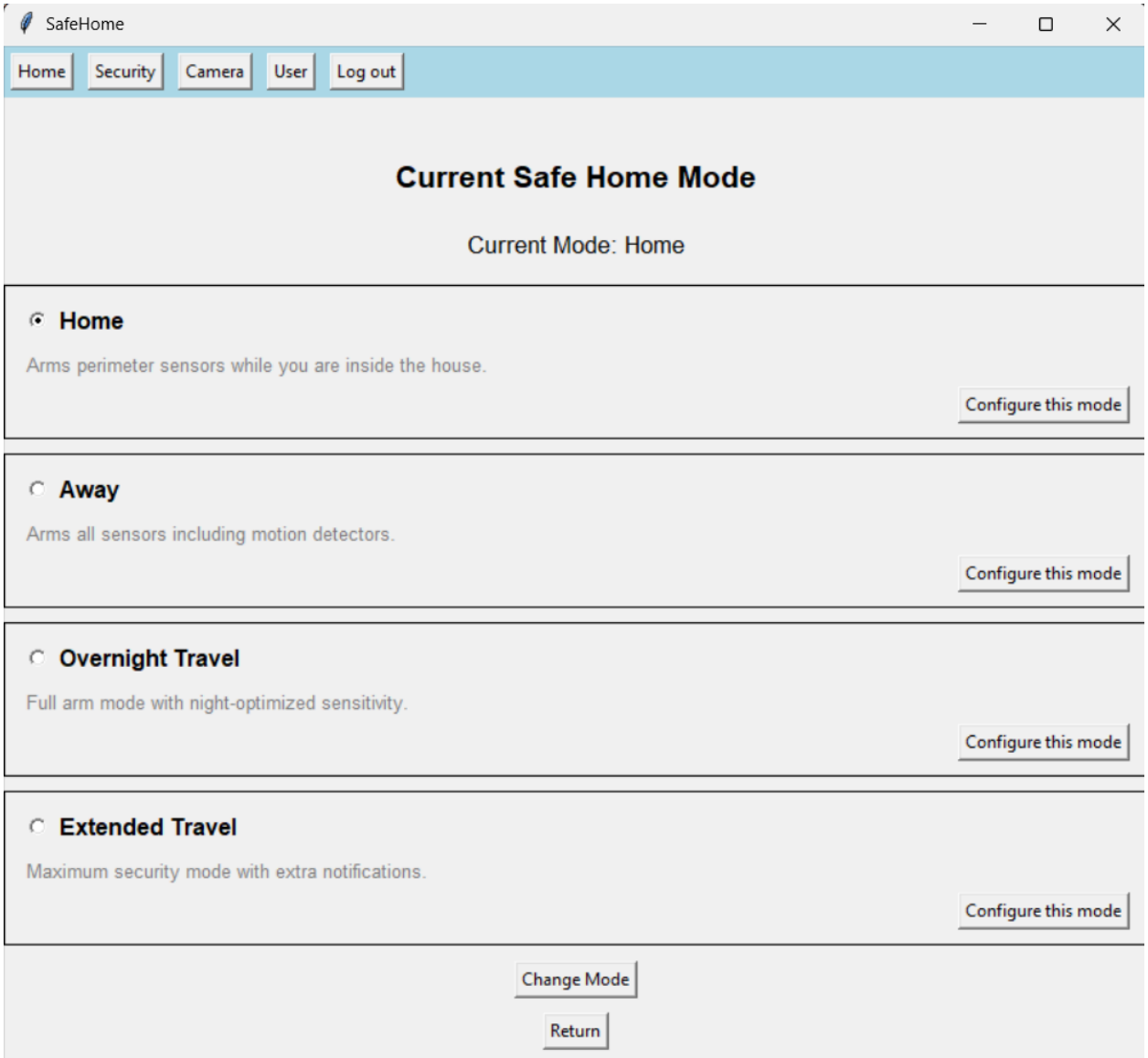


18. The system removes selected safety zone.

x. Change SafeHome modes

Scenario:

1. The homeowner logs onto the system
2. The homeowner selects **"Security" button** on **home page**.
3. The homeowner selects "**SafeHome Mode"** from function buttons.
4. The system display current mode with several mode options.
    a. **Home** – Arms perimeter sensors while you are inside the house
    b. **Away** – Arms all sensors including motion detectors
    c. **Overnight Travel** – Full arm mode with night-optimized sensitivity
    d. **Extended Travel** – Maximum security mode with extra notifications

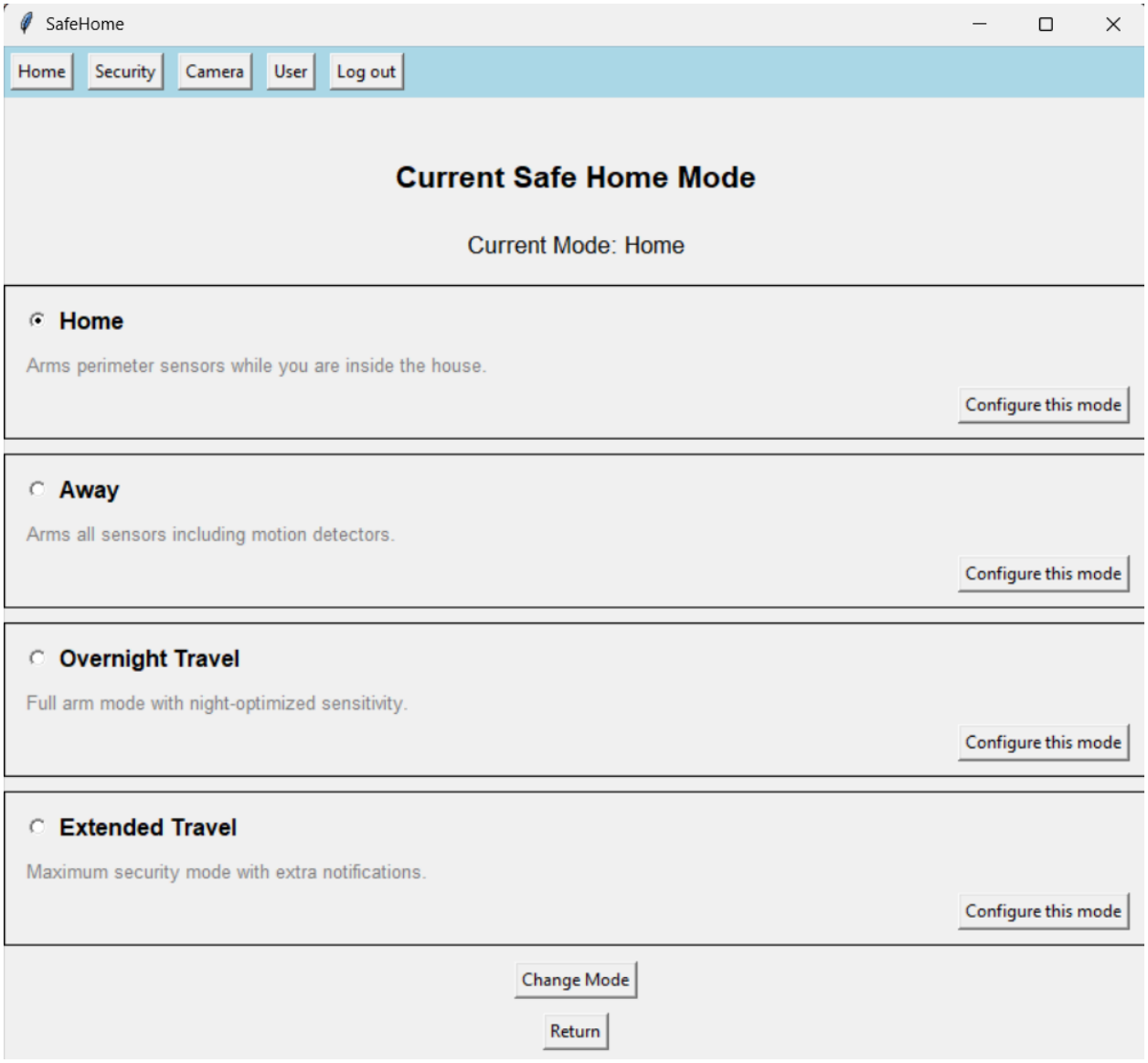


5. The homeowner selects new mode and press **Change Mode button**.

xi. Configure SafeHome modes

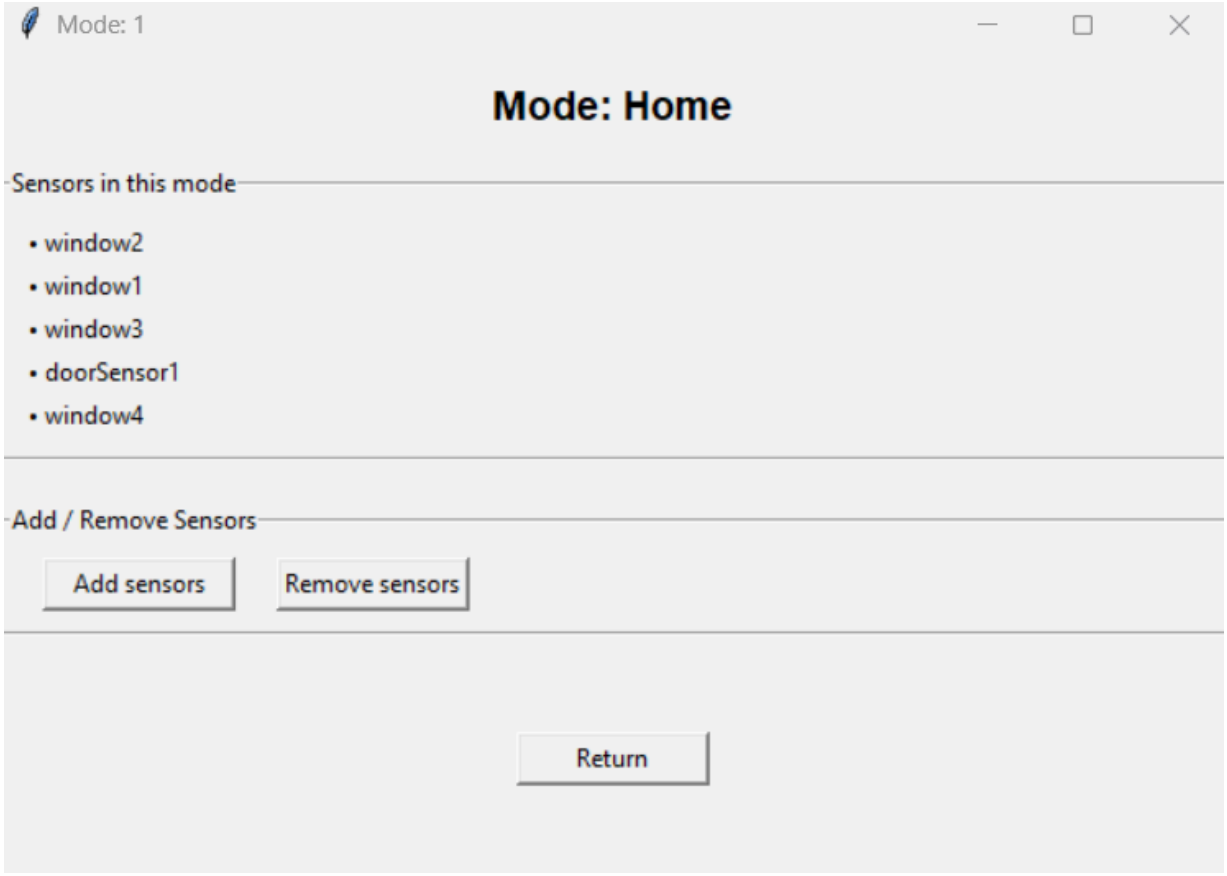
Scenario:

1. The homeowner logs onto the system
2. The homeowner selects **"Security" button** on **home page**.
3. The homeowner selects "**SafeHome Mode"** from function buttons.
4. The system display current mode with several mode options.



5. The home owner press **Configure this mode button** at selected mode

6. The system display configure setting of the selected mode

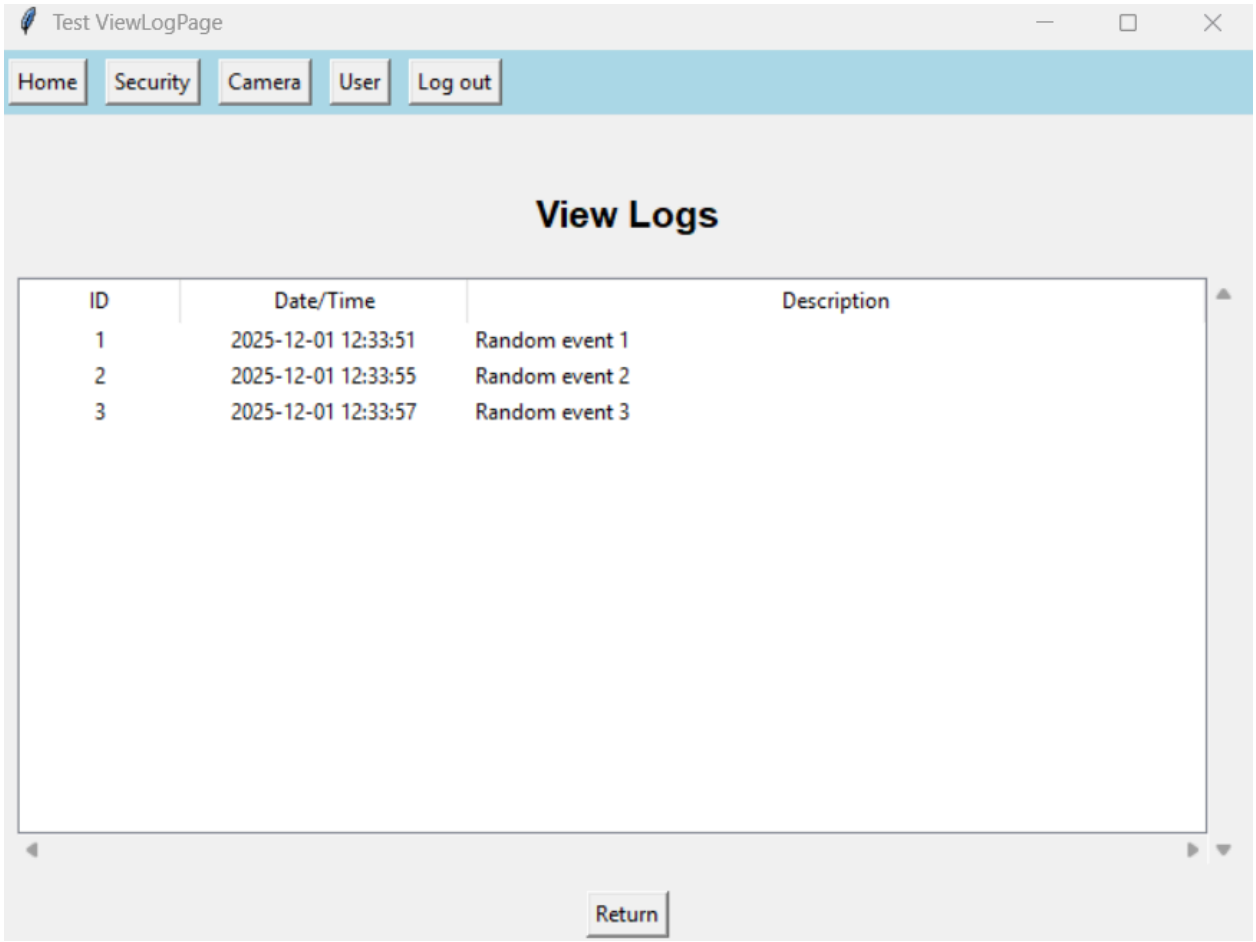


7. The homeowner press **add/remove sensors** to arm sensors for the selected mode.

xii. View intrusion log

Scenario:

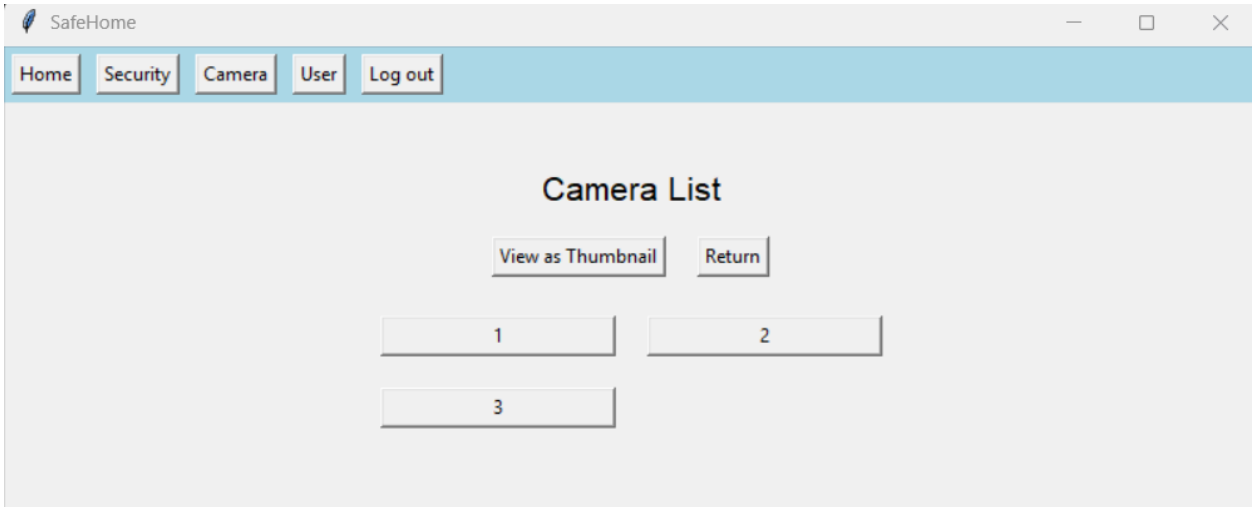
1. The homeowner logs onto the system
2. The homeowner selects **"View Log" button** on **home page**.
3. The system shows the user the saved intrusion log.



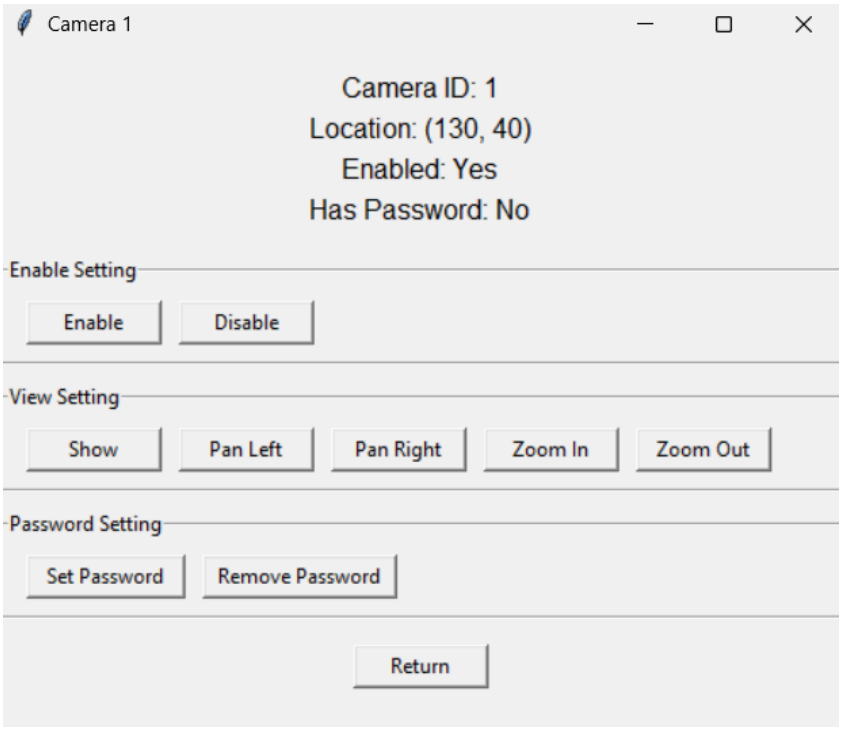
xiii. Display Specific camera view

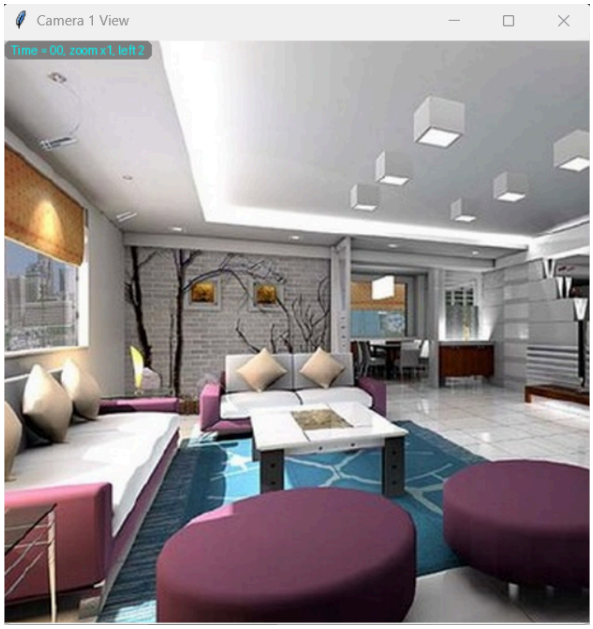
Scenario:

1. The homeowner logs onto the system
2. The homeowner selects **"Camera" button** from **header**/ on **home page**.
3. The system displays all cameras.



4. The homeowner selects a camera.
5. The system asks a password if the selected camera has a password.
6. The homeowner enters the password.
7. The system validates the password.
8. The system displays the state of the selected camera. If camera is enabled, the system also display view of the selected camera

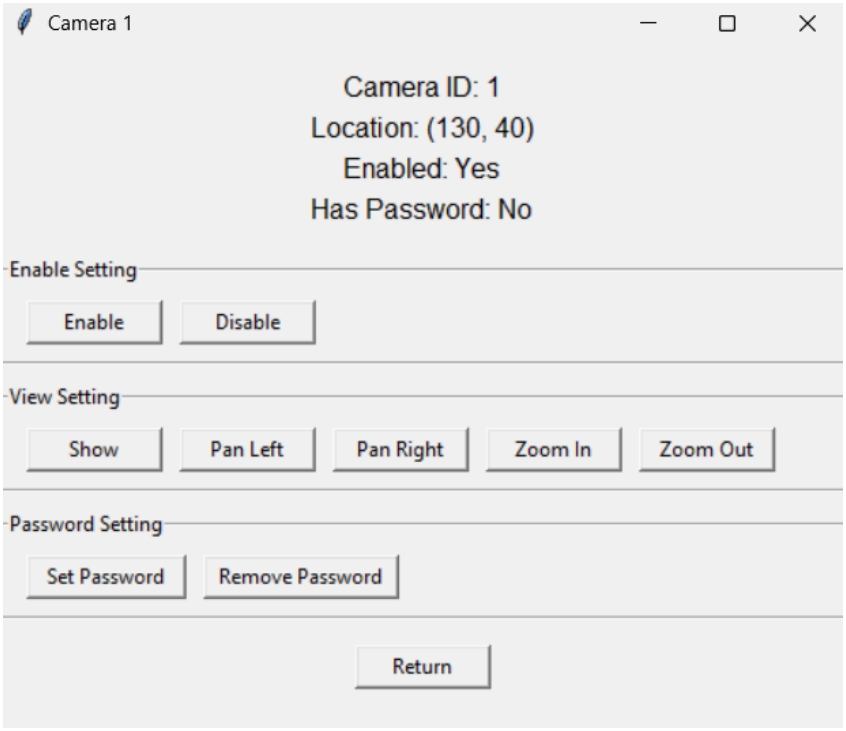


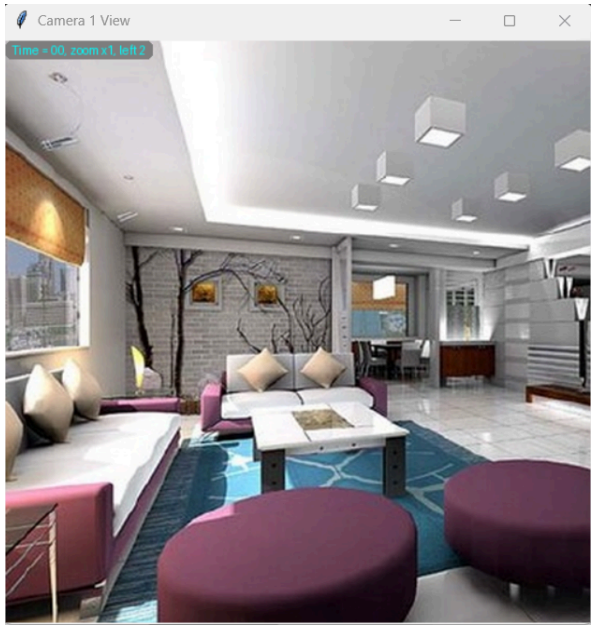


xiv. Pan/Zoom specific camera view

Scenario:

1. The homeowner views specific camera – see How to use SafeHome: "Display specific camera view"
2. The homeowner presses "**zoom in**", "**zoom out**" to zoom the camera, "**Pan Left**" or "**Pan Right**" to pan the camera.

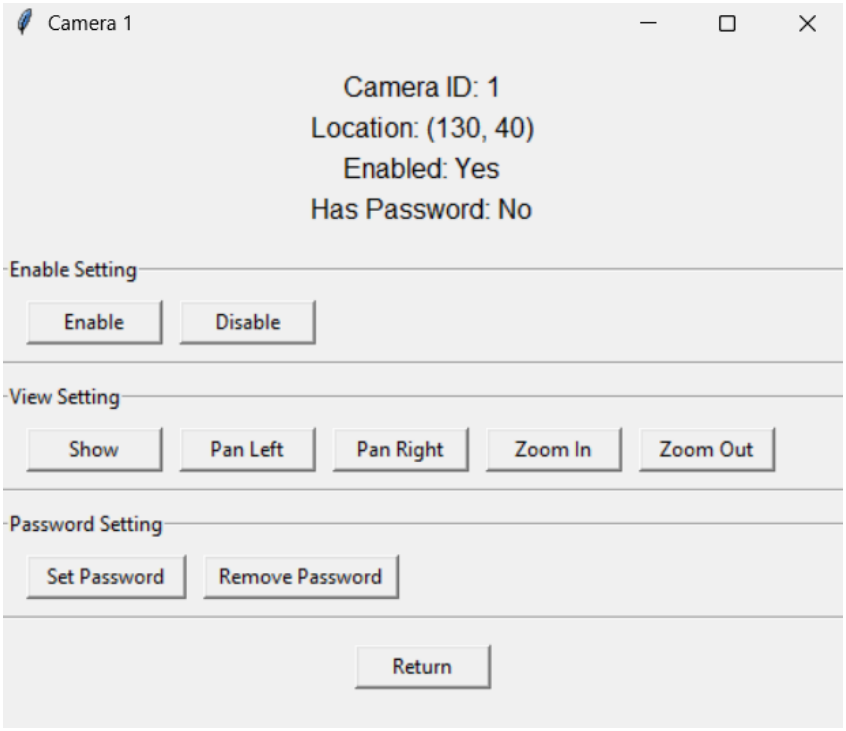


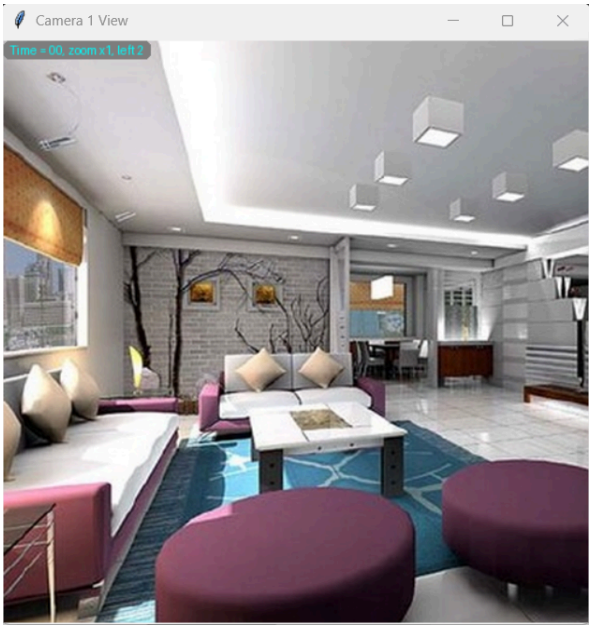


xv. Set/Delete camera password

Scenario:

1. The homeowner views specific camera – see How to use SafeHome: "Display specific camera view"
2. The homeowner presses "**Set Password**" to set/change password of the camera, "**Remove Password**" to remove password of the camera.

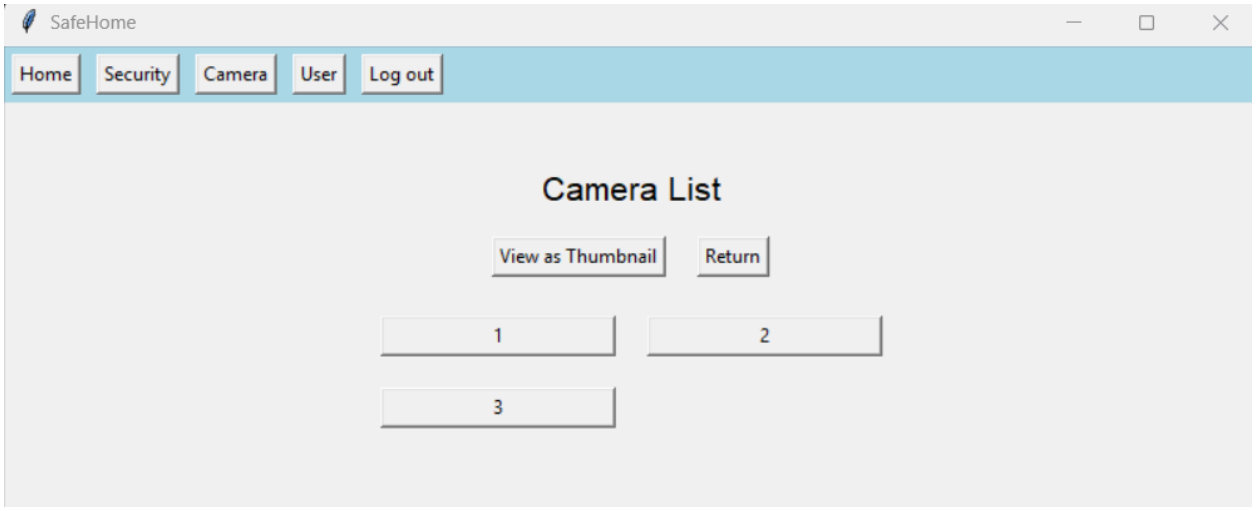




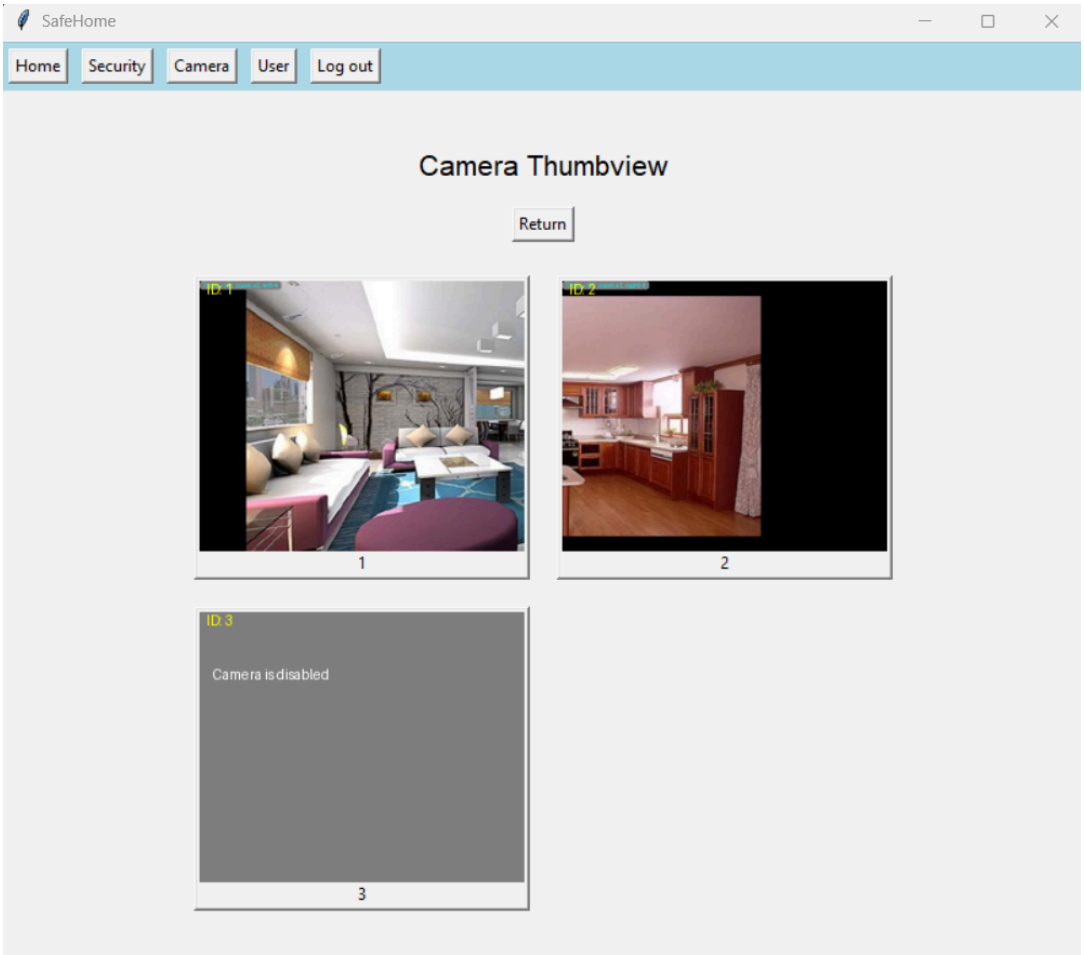
xvi. View thumbnail Shots

Scenario:

1. The homeowner logs onto the system
2. The homeowner selects **"Camera" button** from **header**/ on **home page**.
3. The system displays all cameras.



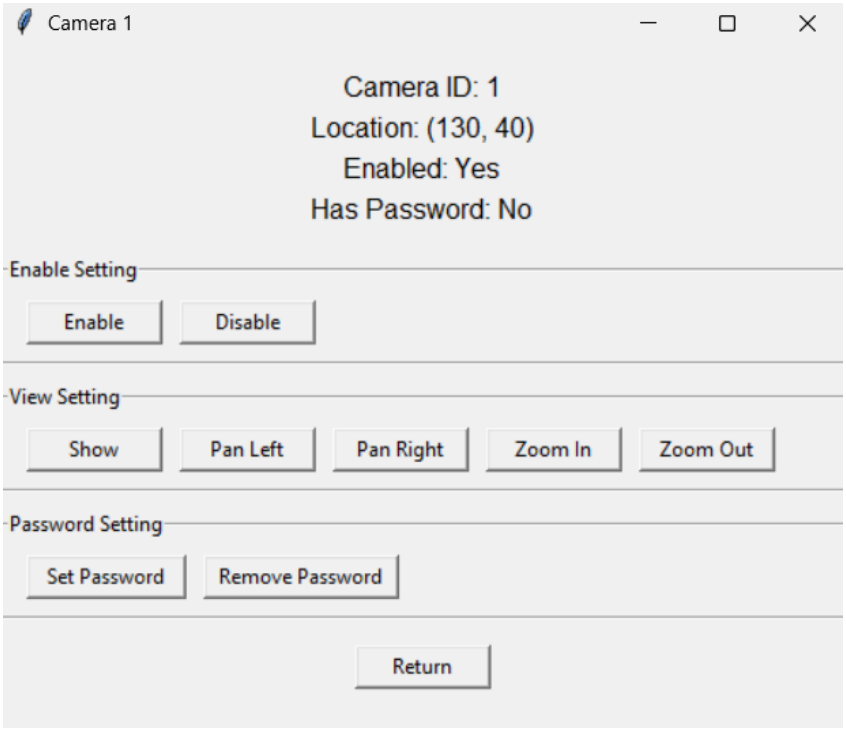
4. The homeowner selects **View as Thumbnail**
5. The system displays all cameras as thumbnails.

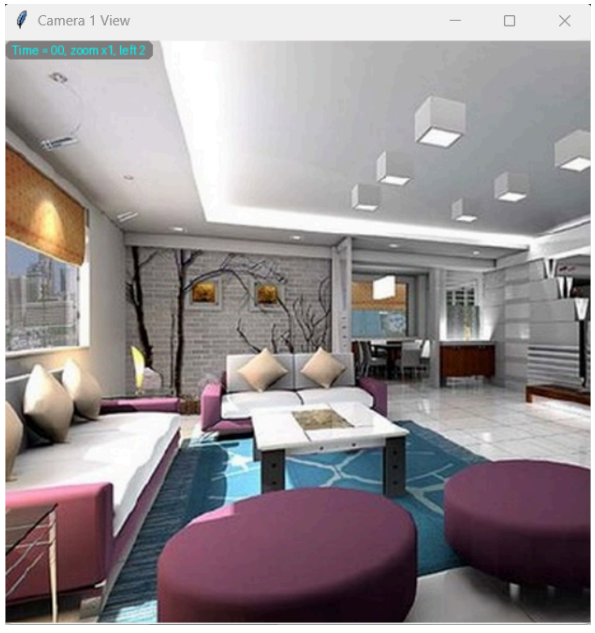


xvii. Enable/Disable camera

Scenario:

1. The homeowner views specific camera – see How to use SafeHome: "Display specific camera view"
2. The homeowner presses "**Enable**" to enable the camera, "**Disable**" to disable the camera.





VII. Advanced Configuration and Developer Notes

Run as a normal user :

```
uv sync

uv run python src/main.py
```

Run as developer :

```
uv sync -extra dev
```

Run unit tests :

```
make test-unit
```

Run unit tests with coverage :

```
make test-unit-cov
```

Run integration tests :

```
make test-integration
```

Run integration tests with coverage :

```
make test-integration-cov
```

Run system tests :

```
make test-system
```

Run system tests with coverage :

```
make test-system-cov
```

Run unit test to see coverage in multi level :

```
uv run python unit_coverage_report.py
```

Run test with manual interaction :

```
uv run python tests/manual_interaction *.py
```

VIII. Appendix A. GLOSSARY

Term	Definition
2FA	Two-factor authentication process for user verification.
Account Status	Current state of a user account (active, locked, suspended).
AlarmManager	Manages alarms, notifications, escalations, and event logging.
Automation Mode	Predefined system configuration controlling multiple devices.
Automation Routines	Scheduled or triggered sequences of automated actions.
AWAY Mode	Fully armed mode; indoor and perimeter sensors active.
Camera	Device capturing video/audio, supports alarms, passwords, and streaming.
CameraManager	Handles camera control, streaming, recording, and alarm events.
CloudServer	Backend managing authentication, data sync, configurations, and notifications.
CloudServer_2FASessionManager	Manages 2FA sessions and verification codes.
CloudServer_AuthAccountManager	Handles login, logout, authentication, and password management.
CloudServer_ConfigProfileManagement	Manages device configurations, version control, and updates to SystemHub.
CloudServer_NotificationDispatchManager	Sends notifications, SMS, emergency alerts, and panic/automation commands.

ConfigManager	Maintains system/device/SafetyZone settings and automation rules.
COSensor	Detects carbon monoxide levels.
Device	Base class for hardware devices handling events and status.
DeviceManager	Manages smart device registration, discovery, and control.
HOME Mode	Partially armed mode; indoor sensors limited, perimeter active.
IVRService	Automated voice system for emergency notifications and calls.
LightDevice	Controls lighting, brightness, color, and automation commands.
LogManager	Manages system and audit logs; stores, filters, and exports events.
MobileApp	User interface for control, playback, notifications, and automation.
ModeManager	Controls global system mode (HOME, AWAY, SLEEP) and applies configurations.
MovementSensor	Detects motion events.
Panic Alert	User-triggered emergency notification.
SLEEP Mode	Night mode; perimeter active, indoor sensors mostly disabled.
SecurityManager	Handles intrusion detection, arming/disarming, and security rules.
SensorManager	Monitors, arms, and validates sensor events.

ShockSensor	Detects vibrations or impacts.
SmartDevices	Connected devices controllable via automation and modes.
SoundAnalyzer	Detects specific sound patterns (glass break, barking, abnormal noise).
SystemHub	Central coordinator integrating modules, processing commands, and syncing data.
User	Account holder storing credentials, contact info, and access rights.
UserManager	Manages user profiles, permissions, and roles.
Video Clip	Recorded segment of camera footage.
VentilationSystem	Controls indoor airflow and reports system state.
StorageRepository	Stores logs, media files, and configuration data.
Live View	Real-time camera video feed.
Two-Way Audio	Bidirectional audio communication through cameras.
Quick Modes	Preset automation configurations for fast system control.
Recording Quality	Video resolution and clarity settings.
Password Lock	Restricts camera access with authentication.