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value through innovation

SecuriTree

Recruiting exercise from EPI-USE Labs

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Contents

1. Problem Statement

Super Secure Systems (S³) is a well-established security firm specialising in physical security and access control management for enterprise-level clients. Their products range from simple door locks to high-end camera systems that feature motion tracking, facial and license plate recognition, and pattern analysis and matching.

S³ started as a very small business in the garage of Mr. Scott M Artlocke, the company's founder, where he developed and produced the very first lock that could securely track the number of times it had been opened. Since then, the company has grown into a multi-national titan in the security industry, with over 100 enterprise-level clients and 53 locations worldwide.

As part of their continuous drive to secure, contain, and protect their client's physical assets, S³ has approached your development start-up to assist with the implementation of a new application called SecuriTree.

SecuriTree is an access control management application that provides a visual tree view of the security and access control units installed in a client's S³ system. This application will allow authorised security operatives to monitor and manage each physical security and access control unit (areas, doors, elevators, floors, etc.), at a client's premises from one central location.

2.   Key contacts

This exercise is provided by EPI-USE Labs. For any queries, please contact:

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3. Technical Requirements

3.1 Application Requirements

Develop the SecuriTree application based on the following requirements provided by S^3.

3.1.1 Allowed Programming Languages

Allowed programming languages:
- ABAP;
- Java;
- JavaScript/TypeScript;
- Python;
- C++;
- C#.

The core logic and functionality of your application must be developed in any of the allowed programming languages.

Note: You can use any styling, mark-up, or scripting languages (CSS, JavaScript, MySQL Scripting Language, etc.) for your application's non-core functionality, such as application styling or data storage and retrieval.

You will be assessed based on your ability to justify the suitability of your choice of programming language for this application.

3.1.2 User Interface

The application must have a visual user interface that displays information to a user and allows them to interact with the application.

User Interface Examples:
- Command-line text interface;
- Desktop application interface;
- Web page interface;
- AR/VR application interface;
- Etc.

You are allowed to use any visual programming/styling/scripting languages to build the visual user interface.

You will be assessed based on the visual appeal and usability of your user interface. See **Section 3.1.4 Application Screens** for information on the screens that you need to design.

3.1.3 Core Functionality

The application must provide the following core functionality.

View Security Entity Hierarchy

The SecuriTree application must allow a user to view all areas, doors and access rules in the system as a tree hierarchy. This tree hierarchy visually represents the relationships between these entities.

The tree hierarchy always starts at the root area in the system. The root area is the only area with a parent_id value of '*null*'.

From the root area, all children areas and doors associated with the root area needs to be displayed. Also display the access rules assigned for each door in the area. For all children areas directly beneath the root area, display all the children areas, doors, and access rules associated with these children. Continue moving through all the child areas and doors recursively until all entities have been processed and appear in the hierarchy.

Hierarchy Example:

- root area
  - door 1 (Locked)
  - access rule 1
  - area a
    - door 2 (Locked), door 3 (Unlocked)
    - access rule 2
    - area aa
      - access rule 3, access rule 4
      - door 4 (Locked), door 5 (Locked), door 6 (Locked)
    - area ac
      - access rule 5
      - door 7 (Locked)
      - area aca
        - access rule 6, access rule 7
        - door 8 (Locked), door 9 (Unlocked)

You are allowed to style the hierarchy however you see fit, but the basic entity information described above must be visible.

Door Management

The SecuriTree application must allow a user to change the state of any door in the system between Locked and Unlocked by providing the door identifier and desired state (Locked, Unlocked) for the door.

Any changes to a door's state must be saved to your data store. The current state of each door must be displayed in the entity hierarchy.

Note: The door identifier is not the same as the door name. In the provided examples and screens, only the door name appears on the entity hierarchy. You will therefore either have to display the door id on the entity hierarchy or allow the user to search for a door id using the door name.

Secure User Access Management System

The SecuriTree application must be protected from unauthorized user access attempts by making use of a secure user access management system. This system must provide login functionality that allows a registered user to access the application securely with a valid username and password combination.

If a user provides a username and password combination that is not stored in the user management system, the user is not authorized, and must not be able to access any application functionality.

You must load the user data in the provided *registered_users.json* file into your user access management system, either manually or through an automated program. Bonus marks will be awarded for automated programs.

Any functionality that uses user data must read it from your user access management system. Your application is not allowed to read the user data directly from the *registered_users.json* file during runtime.

The *registered_users.json* file contains password in plain text format. You are not allowed to store these passwords as plain text in your access management system. You must use an encryption or hashing algorithm to store these passwords securely.

Your application does NOT have to provide functionality to register new users in your access management system.

How you choose to implement your access management system is entirely up to you. You will be assessed based on your ability to justify why your solution is robust, secure, maintainable and user-friendly.

Persistent Secure Data Storage

The SecuriTree application must use a persistent secure data store (such as a database or cloud store) to store information about the physical entities that are managed by the application.

You must load the system data in the provided *system_data.json* file into your persistent data store, either manually or through an automated program. Bonus marks will be awarded for automated programs that handle the data import.

Any functionality that uses system data must read it from your persistent data store. Your application is not allowed to read the system data directly from the *system_data.json* file during runtime.

You will be assessed based on your ability to justify why your solution is robust, secure, maintainable and user-friendly.

3.1.4 Application Screens

The application must include the following screens. These screens may be styled however you see fit, but the information that appears in these examples must be clearly visible.

Login screen

The first screen the user sees when accessing the application. This screen should prompt the user for a username and password to access the application securely.

```
**************************************************
*            SECURITREE — Security Dashboard        *
**************************************************
Welcome to SecuriTree!

Please enter your login credentials to begin.


Username: vaneckj
Password: **********
```

You must evaluate the username and password provided by the user to determine if the provided credentials exist and are valid in your user access management system.

If the login credentials are valid according to your user access management system, the user is authorized to access the application, and must be redirected to the application's Home screen automatically.

If the login credentials are not valid according to your user access management system, the login page should display an appropriate error message and allow the user to retry the login process.

```
**************************************************
*            SECURITREE — Security Dashboard        *
**************************************************
Login failed.

Please enter your login credentials to try again.


Username: vaneckj
Password: **********
```

Home screen

The Home screen should appear for users who successfully log into the application from the Login screen.

```
*************************************************
*          SECURITREE – Security Dashboard          *
*************************************************
Main Menu Options:
1. View Security Entity Hierarchy
2. Manage Doors
3. Log Out

Option: 1
```

This Home screen should have a title bar with the program name (SecuriTree), and a menu that allows the user to navigate to other parts of the program. The user should also be able to log out of the application from the Home screen.

The following navigation links must be present in the menu:

- **View Security Entity Hierarchy:** Opens the Security Entity Hierarchy screen.
- **Manage Doors:** Opens the Manage Doors screen.
- **Log Out:** Logs the user out of the application and redirects the user back to the Login screen.

Security Entity Hierarchy screen

The Security Entity Hierarchy screen should appear when the user selects 'View Security Entity Hierarchy' from the main menu.

```
**************************************************
*         SECURITREE - Security Dashboard ····· *
**************************************************
Entity Hierarchy:

\- WONKA FACTORY
   |- [Doors] Main Gate (UNLOCKED), Factory Front Door (UNLOCKED), Factory Back Door (LOCKED), Secret Entrance Tunnel Grate (UNLOCKED)
   |- [Access Rules] sar-wonka, sar-admin-oompas, sar-oarsmen-oompas, sar-broadcasting-oompas, sar-test-oompas-dclass, sar-miner-oompas,
   |                 sar-declogging-oompas, sar-worker-oompas, sar-squirrels, sar-ticket-holder-access, sar-arcane-oompas
   \- CHOCOLATE ROOM
      |- [Doors] Chocolate Room Entrance (UNLOCKED)
      |- [Access Rules] sar-wonka, sar-admin-oompas, sar-oarsmen-oompas, sar-declogging-oompas, sar-worker-oompas, sar-ticket-holder-access
      \- CHOCOLATE RIVER
         |- [Doors] Chocolate River Entrance (LOCKED)
         |- [Access Rules] sar-wonka, sar-admin-oompas, sar-declogging-oompas, sar-oarsmen-oompas, sar-ticket-holder-access
         \- CHOCOLATE RIVER PIPELINE ONE
            |- [Doors] Pipeline Maintenance Hatch #1 (UNLOCKED), Pipeline Draining Hatch #1 (LOCKED)
            |- [Access Rules] sar-wonka, sar-admin-oompas, sar-declogging-oompas
         \- CHOCOLATE RIVER PIPELINE TWENTY THREE
            |- [Doors] Pipeline Drainage Hatch #42 (UNLOCKED), Oompa Loompa Feeding Tube (UNLOCKED)
            |- [Access Rules] sar-wonka, sar-admin-oompas, sar-declogging-oompas
      \- SUGARGRASS MEADOWS
         |- [Doors] Meadow Fields Hallway (UNLOCKED)
         |- [Access Rules] sar-wonka, sar-admin-oompas, sar-worker-oompas, sar-ticket-holder-access
         \- LAWN MOWER SHED
            |- [Doors] Rickety Wooden Door (UNLOCKED)
            |- [Access Rules] sar-wonka, sar-admin-oompas, sar-worker-oompas
      \- FEAR TUNNEL
         |- [Doors] Fear Tunnel Dock Entrance (LOCKED), Entrance To The Absurd (UNLOCKED)
         |- [Access Rules] sar-wonka, sar-admin-oompas, sar-oarsmen-oompas, sar-arcane-oompas, sar-ticket-holder-access
   \- RESEARCH & DEVELOPMENT
      |- [Doors] R&D Entrance (UNLOCKED), Portal To Forbidden Knowledge (UNLOCKED)
      |- [Access Rules] sar-wonka, sar-broadcasting-oompas, sar-test-oompas-dclass, sar-arcane-oompas, sar-miner-oompas, sar-squirrels,
      |                 sar-ticket-holder-access, sar-admin-oompas, sar-worker-oompas
      \- LICK-ABLE WALLPAPER WALL
         |- [Doors] Wallpaper Room Main Entrance (UNLOCKED), Wallpaper Degreaser Entrance (UNLOCKED)
         |- [Access Rules] sar-wonka, sar-test-oompas-dclass, sar-ticket-holder-access
      \- JUICING ROOM
         |- [Doors] Juicing Room Main Entrance (LOCKED), Juicer Entrance (LOCKED)
         |- [Access Rules] sar-wonka, sar-admin-oompas, sar-worker-oompas
      \- FIZZY-LIFTING DRINK ROOM
         |- [Doors] Fizzy Room Entrance (UNLOCKED), Exhaust Fan (LOCKED), Degassing Chamber Blast Door (LOCKED)
         |- [Access Rules] sar-wonka, sar-test-oompas-dclass, sar-ticket-holder-access
      \- NUT ROOM
         |- [Doors] Nut Room Entrance (LOCKED), Squirrel Entrance (LOCKED)
         |- [Access Rules] sar-wonka, sar-test-oompas-dclass, sar-squirrels, sar-ticket-holder-access
         \- GARBAGE CHUTE
            |- [Doors] Garbage Chute Hatch (UNLOCKED)
            |- [Access Rules] sar-wonka
            \- INCINERATOR
               |- [Doors] Incinerator Chute Entrance (UNLOCKED), Furnace Door (LOCKED)
               |- [Access Rules] sar-wonka
      \- WONKAVISION STUDIO
         |- [Doors] Studio Entrance (LOCKED), Broadcasting Camera #1 (UNLOCKED)
         |- [Access Rules] sar-wonka, sar-broadcasting-oompas, sar-test-oompas-dclass, sar-arcane-oompas, sar-ticket-holder-access
      \- MOUNT FUDGE
         |- [Doors] Tunnel Entrance #1 (LOCKED), Penuche Summit Entrance (UNLOCKED)
         |- [Access Rules] sar-wonka, sar-test-oompas-dclass, sar-miner-oompas
         \- ROCK CANDY MINE
            |- [Doors] Candy Mine Entrance (LOCKED), Crystalizer Entrance Door #7 (UNLOCKED)
            |- [Access Rules] sar-wonka, sar-test-oompas-dclass, sar-miner-oompas

Press ENTER to return to the main menu.
```

This screen must automatically construct and display the full security entity hierarchy from the data available in your data store.

Manage Doors screen

The Manage Doors screen should appear when the user selects 'Manage Doors' from the main menu.

This screen should have a menu with the following options:

- **Lock Door:** Opens the Lock Door screen, where the user can provide the identifier of a door to lock it.
- **Unlock Door:** Opens the Unlock Door screen, where the user can provide the identifier of a door to unlock it.
- **Back:** Returns the user to the Home screen.

```
************************************************
*          SECURITREE – Security Dashboard          *
************************************************
Manage Doors Menu Options:
1. Lock Door
2. Unlock Door
3. Back

Option: 1
```

```
************************************************
*          SECURITREE – Security Dashboard          *
************************************************
Lock Door


Please enter the ID of the door to lock.
Press ESC to return to the door management screen.

Door ID: 094F5C91-0E13-4712-8382-1B4B829C4111
```

```
************************************************
*          SECURITREE – Security Dashboard          *
************************************************
Lock Door


Door 094F5C91-0E13-4712-8382-1B4B829C4111 locked!
Press ENTER to return to the main menu.
```

```
**************************************************
*          SECURITREE - Security Dashboard         *
**************************************************
Unlock Door

Please enter the ID of the door to unlock.

Door ID: 094F5C91-0E13-4712-8382-1B4B829C4111
```

```
**************************************************
*          SECURITREE - Security Dashboard         *
**************************************************
Unlock Door

Door 094F5C91-0E13-4712-8382-1B4B829C4111 unlocked!
Press ENTER to return to the main menu.
```

3.2 System Entities

The following entities will be used in the SecuriTree application:

- **Area:** Represents a physical location (group of buildings, a single building, a single room within a building) at the client's premises. Areas may be associated with other areas and may be nested to any depth. An area may only have one parent area. Areas are associated with doors that exist in the physical area space.

- **Door:** Represents a physical door that exists in an area at the client's premises. A door controls physical access to and from each area. A door can only be assigned to one parent area (many-to-one relationship). Each door is associated with a list of access rules that indicate which people are allowed to use the door. Each door has a Locked or Unlocked state which can be toggled by the SecuriTree application. If a door is unlocked, anyone can use the door. If it is locked, only people in the door's list of access rules are allowed to use the door.

- **Access Rule:** Represents a list of authorized people that are allowed to use a specific door. Different access rules can be associated with different doors (many-to-many relationship). Access rules are indirectly associated with areas through doors assigned to the areas.

- **SecuriTree User**: An authorized person who can access the SecuriTree application to view the entity hierarchy or manage doors.

4. Submission Instructions

Once you are finished with development and testing, and you are satisfied with the quality of your code, submit your application for a technical review.

Submission Instructions:

1. Create a Git repository (how-to) and upload your application's code to this repository's master branch.

2. Create a detailed README file for your project in the Git repository that you created (how-to). This file must include:
    a. A written overview of your project functionality
    b. An architecture diagram of your project infrastructure
    c. Detailed setup instructions to run your application: assume the reviewer only has an internet connection and fresh Windows 10 operating-system installation. Include steps or guides to download and install any dependencies that are required to run your project.

3. Invite your EPI-USE Labs recruiting mentor and recruiting manager as collaborators to the Git repository that you created (how-to).

4. Send an email to your EPI-USE Labs recruiting mentor and recruiting manager to inform them that you have completed the recruiting exercise. Include a link to your Git repository in the email, as well as a compressed version of the Git repository's master branch as an attachment.

5. Give yourself a pat on the back. You have just taken your first step towards becoming a proud member of the EPI-USE Labs team!

6. Your application will be reviewed by the EPI-USE Labs recruiting team. If your application passes review, you will be formally contacted for an interview.

5. Review Criteria

The review criteria for this exercise are designed to evaluate your critical-thinking, problem-solving abilities, creativity, and technical capabilities. These skills are critical for any technical consultant or developer.

5.1 Required Functionality

The criteria specified below are the baseline requirements for your application.

If your application fails to meet any of these criteria, you will fail the technical review immediately.

Required functionality:
- Application loads data directly from a data store (no provided text file processing during runtime)
- Application is protected from simple unauthorized user access attempts
- User can view Login screen
- User can log in on Login screen – successful logins redirect to Home screen
- User can view Home screen
- User can navigate to other application screens from the Home screen by selecting menu options
- User can view Security Entity Hierarchy screen
- Security Entity Hierarchy screen loads and displays the entity hierarchy correctly
- User can view Manage Doors screen
- User can update a door's state to Locked or Unlocked from the Manage Doors screen and subscreens
- User can log out on the Home screen – successful logouts redirect to Login screen

5.2 Additional Review Criteria

If all of the core requirements for your application are met, the following additional criteria will be used.

Additional review criteria:
- System infrastructure
  - Suitability of chosen languages and components
  - Compatibility between chosen languages and components
  - Availability of chosen languages and components
  - Architecture security considerations
  - Logging capabilities
  - Application performance

- Application code
  - Styling consistency (linters are your friend!)
  - Understandability
    - Is the code clear and concise?
    - Is the code self-documenting?
    - In cases where the code is not self-documenting, are there comments that describe the code?
  - Best practices
    - To what extent are best practices followed for the chosen languages and components?
    - In cases where best practices are not followed, can the omission be justified?
  - Application setup complexity
    - How difficult is it to install and run the application on a new system?
  - Security
    - Is the code vulnerable to data leaks?

- User interface
  - Visual appeal
    - Styling consistency
    - Design simplicity
  - Usability:
    - Is it easy for a new user to learn and use the application?
    - Is it easy for a user to perform desired tasks in the application?
    - Is the application documentation relevant, clear, concise and consistent?

5.3   Bonus Marks

It is possible to achieve bonus marks for this exercise by adding useful or interesting features to your application. Marks will be awarded based on the suitability and complexity of the added features.

Additional features may be included in your application functionality, code, user interface or data management system.

6.   EPI-USE Labs: value through innovation

Trusted experts in the SAP domain

EPI-USE Labs is a global company providing software solutions and managed services.

We partner with our clients to optimise the performance, management and security of their SAP® and SAP SuccessFactors systems. Our solutions range from user-friendly apps for day-to-day SAP reporting to complete S/4HANA system migrations. We simplify and speed up landscape and test data management, enable data security, privacy and compliance, provide efficient cloud solutions and managed services, deliver effective Human Capital Management (HCM) and much more.

Our relentless focus on creating innovative, well-engineered solutions, along with our expertise developed over thirty-five years, helps our clients to navigate small and large challenges successfully. We have hubs throughout Europe, the United Kingdom, the Americas, Australia, the Philippines, South Africa and the Middle East. With over 1,100 clients across 49 countries, our 97% client renewal rate speaks for itself.

Our clients tell us every day how EPI-USE Labs has transformed their business operations. We help them to solve their SAP challenges across a wide range of areas, including:

- securing sensitive SAP data
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- simplifying SAP upgrades

At EPI-USE Labs, we have gathered the brightest and most innovative minds in our field. Many of our 350+ employees have extensive SAP experience; our support, consulting and sales teams are seasoned SAP professionals committed to helping our clients get the most out of their systems. In some areas we work in tandem with selected global partners, further evidence of our focus on client satisfaction.

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Ongoing Research and Development (R&D) is a cornerstone of our culture, and we spend around 23% of our revenue on R&D activities every year. This single-minded drive helps us develop superior products and provide ongoing product updates. We make sure that our software is not only at the cutting-edge of technological advancement, but is aligned with our clients' changing needs on an ongoing basis.

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Our expertise is backed by world-class support. Our global support team operates in English, French, German, Spanish, Italian, Hebrew, Korean, Afrikaans and Dutch. All software and user manuals are available in English, with the option of German, French and Spanish for the most popular products. Our software includes a problem-solving assistant which equips support personnel with specific information to simulate the problem scenario and ensure a quick resolution. Our dedicated in-house team provides 24-hour support every working day, with 92% of tickets responded to within 30 minutes.

Client Central: our collaborative community

Client Central is our unique online portal, serving not only as a support system, but also as a central repository for all EPI-USE Labs content and material. All our clients have access to Client Central and can find knowledge base articles, guides and videos, as well as log tickets for assistance. With over 14,000 active users, it's a thriving and active online community and an excellent platform for collaboration.

groupelephant.com and Elephants, Rhinos & People ('ERP')

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Should we be successful in winning this engagement, we will channel 1% (one percent) of our net revenues deriving therefrom, to ERP projects. You would be able to choose from a range of projects towards which the funds would be directed, and our ERP staff will provide you with ongoing monitoring and evaluation, and reporting, at your election. Please note that the monies do not constitute an elective add-on to our fees, but would rather be taken out of our revenues.

Please visit www.erp.ngo for examples of our current initiatives and interventions.

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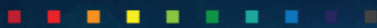
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