Secure Card System

You are tasked with implementing the business logic for a card access system for a government building in C++. The system will allow users and administrators to interact with the system through a console-based interface and handle access based on the floors and employees clearance levels.

System Requirements

All requirements for the system.

1. Functional Requirements

All the business logic for the system.

1.1. Role based

When the program starts, the user should be prompted with choosing either to enter as a user, admin or exit the program.

```
----- SECURE CARD SYSTEM -------
[1] User
[2] Admin
[0] Exit
>
```

1.2. User login

The user should be prompted to enter their employee ID or their name.

```
----- SECURE CARD SYSTEM -------
* User login *
Enter employee id or name:
```

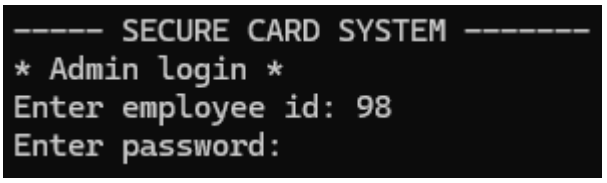
1.3. User Operations

When logged in as a user they should be allowed the following functions:

- List all available floors
    - Access floor (the program should both log and print out the result)
    - Back
- Show personal information about the logged in employee
  (name, email, phone, card id and card clearance level).
    - Change information (only name, phone number and email)
    - Back
- Log out (back to start of program)

1.4. Admin login

When logging in as admin, they need to enter their employee id and then their password.



1.5. Admin Operations

When logged in as an admin they should be allowed the following functions:

- List all floors
    - Choose floor
        - List access history of that floor
        - Change floor information (name and clearance level)
- List all users
    - Choose user (by id or name)
        - Change user information (name, email, phone)
        - Delete user - should also delete their card
- Create a new user - also needs to create a card for the user.
- Log out (back to start of program)

1.6. User

Contains:

- Id (must be unique)
- Name
- Email
- Phone number
- Card (not null)

1.7. Admin

Contains:

- Id (must be unique)
- Password
- Name
- Email
- Phone number
- Card

1.8. Floor

Contains:

- Id - must be unique
- Name - must be unique
- ClearanceLevel
- AccessHistory

1.9. Card

A card can only, and must, have one owner. There should be no owners sharing cards and no floating cards without owners.
Contains

- Id (must be unique)
- ClearanceLevel

2. Non-functional Requirements

All non-business logic requirements for this system.

2.1. Persistence

All data shall be persistent, read and saved in CSV format. When the program starts - it should read from the data sources and not generate elements based on hardcoded values in the program.

2.2. Validation

The following data **must** be validated

- Password - minimum 8 characters long, 1 uppercase, 1 lowercase, 1 number and 1 special character.
- Email - local@domain.tld (at least one dot in the domain).
- Phone number - 07XXXXXXXX or +467XXXXXXXX

2.3. Exceptions

All exceptions for input operations should be handled and not crash the system.

2.4. Logging

Every floor should have an access-log, displaying which people have accessed the floor, at what time and if they were authorized to enter. The logs don’t need to be persistent.

3. Non-functional Requirements (Stretch)

3.1. Cache (Templated)

Small cache for the 10 latest searches in the system. The search functions should always look in the cache first.

3.2. System filler

Create a program or script that generates 1000 validated users (with cards) and 1 admin to handle the system.

3.3. Multithreading

The user shall at all times be able to put in the command “scs -save” which opens a thread that saves all of the current data in memory to our persistent memory.

Grading

1. Deliverable

- The complete program must be submitted via a private GitHub repository and shared with the examiner (@lafftale1999).
- The student must also perform a live demonstration in a small group, where the program is run and key features are shown.
- During the demo, the student must be able to explain key design and implementation decisions, as well as answer questions regarding the codebase.

2. Grading

2.1. Pass (G)

- All functional and non-functional requirements marked as G are correctly implemented and working as intended.
- The system runs without crashes and fulfills the specified user and admin operations.
- The student can clearly explain how the program works.

2.2. Pass with distinction (VG)

- All requirements for Grade G are met in full.
- All VG-level requirements are fully implemented and functional.
- The student demonstrates:
    - Consistent naming conventions
    - Good folder structure
    - Efficient and non-repetitive code following DRY principles
    - Good use of STL
- The student can articulate and justify their design and implementation decisions, showing an understanding of advanced C++ concepts and system design principles.

Learning objectives

- Describe the C++ language and its syntax, structure, functions, and relevant concepts
- Explain memory management, references, and pointers within C++
- Describe relevant advanced data structures and algorithms
- Describe libraries and templates in C++
- Describe object-oriented programming and classes, objects, inheritance, and polymorphism
- Explain multi-threaded software
- Develop applications in C++ at a specialized level while utilizing relevant functions, libraries, and templates
- Plan and develop multi-threaded software and being able to apply advanced data structures and algorithms
- Show testing, debugging and troubleshooting of applications in C++
- Apply and compare procedural and object-oriented programming techniques
- Manage and comprehend dynamic and static memory management
- Communicate commitments and solutions in the development of applications in C++ at a professional level
- Independently develop and debug software applications in C++ based on given requirements
- Independently identify and address a problem and be able to choose the appropriate tools and methods to solve the issue at hand
- Independently drive development in C++ by selecting suitable tools and methods like CMakeFiles.