

Project Report – File Vault Management System

Course: Data Structures

Project Title: File Vault Management System using MVC Architecture

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1. Abstract

The File Vault Management System is a secure file-handling application developed using the **MVC (Model-View-Controller)** architecture in the **C programming language**.

It allows users to create password-protected files, access them, append data, track recently accessed files, and perform undo operations.

The system uses **two data structures**:

- **Queue** – to maintain a list of recently accessed files (FIFO behavior).
- **Stack** – to store undo operations for appended content (LIFO behavior).

This modular architecture ensures clean separation of logic, improved maintainability, and easy scalability. The application simulates real-world secure vault operations such as authentication, file access control, and history tracking.

2. Problem Statement

Managing multiple files securely and efficiently is a common real-world requirement.

Users need:

- Password protection
- Quick access to frequently used files
- Undo support for accidental edits
- A clean structure that separates interface, logic, and data

3. Use Cases

1. Add New File

- User creates a new file and sets a password.

2. Access File

- User authenticates and either views or appends content.

3. Change Password

- User updates the password of an existing file.

4. View Recent Files

- User checks the list of up to 5 recently accessed files.

5. Undo Last Append

- User reverts the most recent append operation.

4. Algorithm

4.1 Main Menu :

- 1.Load vault data.
- 2.Initialize structures (Queue + Stack).
- 3.Display menu.
- 4.Get user choice.
- 5.Call appropriate controller function.
- 6.Repeat until user selects Exit.

4.2 Add File :

- 1.Input filename and password.
- 2.Check if file already exists.
- 3.Create new file.
- 4.Save filename and password to vault.
- 5.Update vault file (`vault.txt`).

4.3 Access File :

- 1.Input filename.
- 2.Check if file exists.
- 3.Ask user for password.
- 4.If correct:

- Add file to recent queue.
- Show options: View or Append.

5.If View: display file contents.

6.If Append: allow multiline input, write to file, push undo entry.

4.4 Recent Files (Queue) :

1.When a file is accessed:

- Remove duplicates
- If queue is full, remove oldest
- Insert file at rear

2.Display queue when requested.

4.5 Undo Append (Stack) :

1.When text is appended, push (`filename, length`) onto stack.

2.On undo request:

- Pop last operation
- Truncate file by the appended length.

5. Implementation

The codebase is divided into three modules:

1. Model

Handles:

- `model_addFile()`
- `model_changePassword()`
- `model_verifyPassword()`
- `model_getFileContents()`
- `model_appendToFile()`
- `model_recordRecent()`
- `model_undoLastAppend()`

Data structures used:

- Queue for tracking recent files
- Stack for undo operations

2. View

Handles:

- Menu display
- Reading user choices
- Masking passwords
- Showing file content
- Printing errors/messages

3. Controller

Handles:

- Menu loop
- Validation
- Passing data between model and view
- High-level program flow

6. Screenshots of Outputs

The screenshot shows a terminal window with three tabs at the top: 'brave', 'dolphin', and 'project:zsh'. The current tab is 'project:zsh' and it contains the following session output:

```
kar908:brave ~ kar908:dolphin ~ project:zsh ~
~/Academics/DS/project ./fv

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 1
Enter filename: 1.txt
Set a password for this file: 1.txt
File added and protected successfully.

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 1.txt
Enter password: *****
1. View file
2. Append to file
Enter your choice: 1
Contents of 1.txt:

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 1.txt
Enter password: *****
1. View file
2. Append to file
Enter your choice: 2
Enter text to append (single dot "." on its own line to finish):
this is 1.txt
second line.
third line.
.
Content appended successfully.

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
```

New Tab Split View

kar908 : brave × kar908 : dolphin ×

project : zsh ×

project : oosplash ×

```
6. Exit  
Enter your choice: 2  
Enter filename: 1.txt  
Enter password: *****  
1. View file  
2. Append to file  
Enter your choice: 1  
Contents of 1.txt:  
this is 1.txt  
second line.  
third line.
```

```
--- FILE VAULT MENU ---  
1. Add New File  
2. Access File  
3. Change Password  
4. Show Recent Files  
5. Undo Last Append  
6. Exit  
Enter your choice: 3  
Enter filename: 1.txt  
Enter current password: *****  
Enter new password: 1txt  
Password changed successfully.
```

```
--- FILE VAULT MENU ---  
1. Add New File  
2. Access File  
3. Change Password  
4. Show Recent Files  
5. Undo Last Append  
6. Exit  
Enter your choice: 2  
Enter filename: 1.txt  
Enter password: *****  
Incorrect password!
```

```
--- FILE VAULT MENU ---  
1. Add New File  
2. Access File  
3. Change Password  
4. Show Recent Files  
5. Undo Last Append  
6. Exit  
Enter your choice: 2  
Enter filename: 1.txt  
Enter password: *****  
1. View file  
2. Append to file  
Enter your choice: 1  
Contents of 1.txt:  
this is 1.txt  
second line.  
third line.
```

```
>New Tab Split View
kar908 : brave × kar908 : dolphin × project : zsh × project : oosplash ×

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 4
Recent files (1 = most recent):
1. 1.txt
Enter a number to open that file (0 to cancel): 0

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 1.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 2
Enter text to append (single dot "." on its own line to finish):
to be undone
.
Content appended successfully.

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 1.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 1
Contents of 1.txt:
this is 1.txt
second line.
third line.
to be undone

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
```

New Tab Split View

kar908:brave × kar908:dolphin × project:zsh × project:oosplash ×

5. Undo Last Append
6. Exit
Enter your choice: 5
Undo complete for file: 1.txt

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 2
Enter filename: 1.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 1
Contents of 1.txt:
this is 1.txt
second line.
third line.

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 5
Undo complete for file: 1.txt

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 2
Enter filename: 1.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 1
Contents of 1.txt:

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

New Tab Split View

kar908:brave × kar908:dolphin × project:zsh × project:oosplash ×

```
Enter your choice: 1
Enter filename: 2.txt
Set a password for this file: 2txt
File added and protected successfully.
```

```
--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
```

```
Enter your choice: 1
Enter filename: 2.txt
File already exists!
```

```
--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
```

```
Enter your choice: 1
Enter filename: 3.txt
Set a password for this file: 3txt
File added and protected successfully.
```

```
--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
```

```
Enter your choice: 1
Enter filename: 4.txt
Set a password for this file: 4txt
File added and protected successfully.
```

```
--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
```

```
Enter your choice: 1
Enter filename: 5.txt
Set a password for this file: 5txt
File added and protected successfully.
```

```
--- FILE VAULT MENU ---
1. Add New File
2. Access File
```

New Tab Split View

kar908 : brave × kar908 : dolphin × project : zsh × project : oosplash ×

```
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 1
Enter filename: 6.txt
Set a password for this file: 6txt
File added and protected successfully.

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 4
Recent files (1 = most recent):
1. 1.txt
Enter a number to open that file (0 to cancel): 0

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 2.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 2
Enter text to append (single dot "." on its own line to finish):
abcd
hi
bye.
.
Content appended successfully.

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 4.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 1
Contents of 4.txt:
```

New Tab Split View

kar908 : brave × kar908 : dolphin × project : zsh × project : oosplash ×

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 2

Enter filename: 6.txt

Enter password: ****

1. View file
2. Append to file

Enter your choice: 1

Contents of 6.txt:

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 5.txt

Undo complete for file: 2.txt

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 2

Enter filename: 5.txt

Enter password: ****

1. View file
2. Append to file

Enter your choice: 1

Contents of 5.txt:

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 4

Recent files (1 = most recent):

1. 5.txt
2. 6.txt
3. 4.txt
4. 2.txt
5. 1.txt

New Tab Split View

kar908:brave × kar908:dolphin × project:zsh × project:oosplash ×

Enter a number to open that file (0 to cancel): 0

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 2

Enter filename: 3.txt

Enter password: ****

1. View file
2. Append to file

Enter your choice: 1

Contents of 3.txt:

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 4

Recent files (1 = most recent):

1. 3.txt
2. 5.txt
3. 6.txt
4. 4.txt
5. 2.txt

Enter a number to open that file (0 to cancel): 3

Enter password: ****

1. View file
2. Append to file

Enter your choice: 1

Contents of 6.txt:

--- FILE VAULT MENU ---

1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit

Enter your choice: 4

Recent files (1 = most recent):

1. 6.txt
2. 3.txt
3. 5.txt
4. 4.txt
5. 2.txt

Enter a number to open that file (0 to cancel): 5

Enter password: ****

1. View file

New Tab Split View

kar908 : brave × kar908 : dolphin × project : zsh × project : oosplash ×

2. Append to file

Enter your choice: 2

Enter text to append (single dot "." on its own line to finish):

abcd

hi

.

Content appended successfully.

--- FILE VAULT MENU ---

1. Add New File

2. Access File

3. Change Password

4. Show Recent Files

5. Undo Last Append

6. Exit

Enter your choice: 4

Recent files (1 = most recent):

1. 2.txt

2. 6.txt

3. 3.txt

4. 5.txt

5. 4.txt

Enter a number to open that file (0 to cancel): 0

--- FILE VAULT MENU ---

1. Add New File

2. Access File

3. Change Password

4. Show Recent Files

5. Undo Last Append

6. Exit

Enter your choice: 5

Undo complete for file: 2.txt

--- FILE VAULT MENU ---

1. Add New File

2. Access File

3. Change Password

4. Show Recent Files

5. Undo Last Append

6. Exit

Enter your choice: 5

Nothing to undo.

--- FILE VAULT MENU ---

1. Add New File

2. Access File

3. Change Password

4. Show Recent Files

5. Undo Last Append

6. Exit

Enter your choice: 4

Recent files (1 = most recent):

1. 2.txt

2. 6.txt

New Tab Split View

kar908 : brave × kar908 : dolphin × project : zsh × project : oosplash ×

```
3. 3.txt
4. 5.txt
5. 4.txt
Enter a number to open that file (0 to cancel): 3
Enter password: ****
1. View file
2. Append to file
Enter your choice: 2
Enter text to append (single dot "." on its own line to finish):
abcdefg
lkjhgfds
.
Content appended successfully.

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 2
Enter filename: 6.txt
Enter password: ****
1. View file
2. Append to file
Enter your choice: 1
Contents of 6.txt:

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 4
Recent files (1 = most recent):
1. 6.txt
2. 3.txt
3. 2.txt
4. 5.txt
5. 4.txt
Enter a number to open that file (0 to cancel): 0

--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 5
Undo complete for file: 3.txt
```

```
--- FILE VAULT MENU ---
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
Enter your choice: 4
Recent files (1 = most recent):
1. 6.txt
2. 3.txt
3. 2.txt
4. 5.txt
5. 4.txt
Enter a number to open that file (0 to cancel): 0
```

```
--- FILE VAULT MENU ---
```

```
1. Add New File
2. Access File
3. Change Password
4. Show Recent Files
5. Undo Last Append
6. Exit
```

```
Enter your choice: 6
```

```
Exiting...
```

```
▶ ➤ ~/Academics/DS/project ➤ █
```

7. Future Scope

- Encrypt stored files instead of plain text
- Add user accounts with roles
- Implement a GUI version
- Add ability to delete files
- Allow sorting/search in recent list
- Cloud backup support

8. Learning Outcomes

During this project, we learned:

- How to design and implement MVC architecture in C
- Working with real file systems (`fopen`, `fread`, `fwrite`)
- Implementing and applying Queue and Stack data structures
- Secure password input using `<termios.h>`
- Managing multi-file programs and modular design
- Understanding separation of concerns (Model vs View vs Controller)
- How to write structured and maintainable C code