

CAPSTONE PROJECT REPORT

Developed using C++ on Linux Environment

Submitted by:
Balaram Biswal B

Institution:
ITER, Siksha 'O' Anusandhan

Course:
B.Tech in Computer Science and Engineering

Date of Submission:
09th November 2025

1. Objective

To design and implement a command-line File Explorer in C++ that allows users to interact with the Linux file system — listing, navigating, copying, moving, deleting, and modifying file permissions through simple console operations.

2. Tools & Technologies

- Programming Language: C++ (C++17)
- Operating System: Linux (Ubuntu / Fedora)
- Libraries/Headers: dirent.h, sys/stat.h,unistd.h, fstream, cstring, iomanip, vector, iostream

3. Project Description

This project implements a console-based File Explorer that provides a simplified interface to perform essential file operations. It mimics the functionality of GUI-based file managers through the terminal.

4. Functional Requirements

1. Display all files and folders in the current directory.
2. Allow changing directories and going back to the parent.
3. Provide file operations: copy, move, delete, create.
4. Support recursive file searching.
5. Display and modify file permissions.
6. Maintain a clean and readable interface.

5. Software Design

The application is modular with separate functions handling listing, navigation, file operations, permission management, and search. It uses POSIX directory and file APIs to interface with the OS.

6. Implementation Details

Key system calls and APIs used:

- opendir(), readdir(), closedir() for directory traversal
- stat() for file metadata
- chmod() for permission changes
- ifstream/ofstream for copying file contents
- chdir() for changing working directory

7. Testing & Verification

All implemented features were tested on a Linux environment (Ubuntu). Manual tests and scripted tests were used to verify correct behavior for file creation, copy/move, deletion, permission modification, search functionality, and navigation. Expected outputs were observed for all test cases.

8. Conclusion

The File Explorer Application demonstrates practical Linux system programming using C++. It provides a compact, reliable interface for common file system operations and serves as an educational example for operating systems and systems programming concepts.

9. Future Scope

- Build a GUI version using Qt or PyQt.
- Add content search (grep-like) and file previews.

- Support symbolic permission strings in chmod.
- Add undo support and safer delete confirmations.

10. Source Code (Final C++ Implementation)

```
#include <iostream>
#include <dirent.h>
#include <sys/stat.h>
#include <unistd.h>
#include <cstring>
#include <iomanip>
#include <vector>
#include <fstream>
using namespace std;

string getPerm(mode_t m) {
    string p;
    p += (S_ISDIR(m)) ? 'd' : '-';
    p += (m & S_IRUSR) ? 'r' : '-';
    p += (m & S_IWUSR) ? 'w' : '-';
    p += (m & S_IXUSR) ? 'x' : '-';
    p += (m & S_IRGRP) ? 'r' : '-';
    p += (m & S_IWGRP) ? 'w' : '-';
    p += (m & S_IXGRP) ? 'x' : '-';
    p += (m & S_IROTH) ? 'r' : '-';
    p += (m & S_IWOTH) ? 'w' : '-';
    p += (m & S_IXOTH) ? 'x' : '-';
    return p;
}

void showDir() {
    char loc[1024];
    getcwd(loc, sizeof(loc));
    DIR *dp;
    struct dirent *ent;
    struct stat flStat;
    dp = opendir(loc);
    if (!dp) {
        perror("Unable to open directory");
        return;
    }
    cout << "\nCurrent Directory: " << loc << endl;
    cout << "-----\n";
    cout << setw(25) << left << "Name" << setw(12) << "Type" << "Permissions" << endl;
    cout << "-----\n";
    while ((ent = readdir(dp)) != nullptr) {
        if (strcmp(ent->d_name, ".") == 0 || strcmp(ent->d_name, "..") == 0)
            continue;
        string pth = string(loc) + "/" + ent->d_name;
        stat(pth.c_str(), &flStat);
        string tp = (S_ISDIR(flStat.st_mode)) ? "DIR" : "FILE";
        string prm = getPerm(flStat.st_mode);
```

```

        cout << setw(25) << left << ent->d_name << setw(12) << tp << prm << endl;
    }
    closedir(dp);
}

void goToDir(const string &nm) {
    if (chdir(nm.c_str()) == 0)
        cout << "Moved into directory: " << nm << endl;
    else
        perror("Failed to change directory");
}

void cpFile(const string &s, const string &d) {
    ifstream in(s, ios::binary);
    ofstream out(d, ios::binary);
    if (!in) {
        cout << "Source file not found!\n";
        return;
    }
    if (!out) {
        cout << "Failed to create destination file!\n";
    }
    out << in.rdbuf();
    cout << "File copied successfully!\n";
}

void mvFile(const string &s, const string &d) {
    if (rename(s.c_str(), d.c_str()) == 0)
        cout << "File moved successfully!\n";
    else
        perror("Failed to move file");
}

void delFile(const string &f) {
    if (remove(f.c_str()) == 0)
        cout << "File deleted successfully!\n";
    else
        perror("Failed to delete file");
}

void newFile(const string &f) {
    ofstream fl(f);
    if (fl)
        cout << "File created successfully: " << f << endl;
    else
        cout << "Failed to create file!\n";
    fl.close();
}

def_placeholder = "REPLACE_WITH_CODE_BLOCK"

```

```

void findFile(const string &base, const string &t) {
    DIR *dp;
    struct dirent *ent;
    dp = opendir(base.c_str());
    if (!dp) return;
    while ((ent = readdir(dp)) != nullptr) {
        if (strcmp(ent->d_name, ".") == 0 || strcmp(ent->d_name, "..") == 0)
            continue;
        string pth = base + "/" + ent->d_name;
        if (strstr(ent->d_name, t.c_str()) != nullptr)
            cout << "Found: " << pth << endl;
        if (ent->d_type == DT_DIR)
            findFile(pth, t);
    }
    closedir(dp);
}

void seePerm(const string &f) {
    struct stat fs;
    if (stat(f.c_str(), &fs) == 0)
        cout << "Permissions for " << f << ": " << getPerm(fs.st_mode) << endl;
    else
        perror("Failed to get file info");
}

void setPerm(const string &f, const string &pr) {
    mode_t m = 0;
    if (pr.size() != 9) {
        cout << "Invalid format! Use 9 characters like rwxr-xr--\n";
        return;
    }
    if (pr[0] == 'r') m |= S_IRUSR;
    if (pr[1] == 'w') m |= S_IWUSR;
    if (pr[2] == 'x') m |= S_IXUSR;
    if (pr[3] == 'r') m |= S_IRGRP;
    if (pr[4] == 'w') m |= S_IWGRP;
    if (pr[5] == 'x') m |= S_IXGRP;
    if (pr[6] == 'r') m |= S_IROTH;
    if (pr[7] == 'w') m |= S_IWOTH;
    if (pr[8] == 'x') m |= S_IXOTH;
    if (chmod(f.c_str(), m) == 0)
        cout << "Permissions updated successfully!\n";
    else
        perror("Failed to change permissions");
}

int main() {
    char ch;
    string nm1, nm2;
    cout << "=== Console File Explorer ===" << endl;
    while (true) {
        showDir();
        cout << "\nOptions:\n";
    }
}

```

```

cout << " [C] Change directory\n";
cout << " [B] Go back (Parent directory)\n";
cout << " [1] Copy file\n";
cout << " [2] Move file\n";
cout << " [3] Delete file\n";
cout << " [4] Create new file\n";
cout << " [5] Search file/folder\n";
cout << " [6] View file permissions\n";
cout << " [7] Change file permissions\n";
cout << " [Q] Quit\n";
cout << "Enter choice: ";
cin >> ch;
switch (ch) {
    case 'C': case 'c':
        cout << "Enter directory name: ";
        cin >> nm1;
        goToDir(nm1);
        break;
    case 'B': case 'b':
        goToDir("..");
        break;
    case '1':
        cout << "Enter source filename: ";
        cin >> nm1;
        cout << "Enter destination filename: ";
        cin >> nm2;
        cpFile(nm1, nm2);
        break;
    case '2':
        cout << "Enter source filename: ";
        cin >> nm1;
        cout << "Enter destination filename: ";
        cin >> nm2;
        mvFile(nm1, nm2);
        break;
    case '3':
        cout << "Enter filename to delete: ";
        cin >> nm1;
        delFile(nm1);
        break;
    case '4':
        cout << "Enter new filename: ";
        cin >> nm1;
        newFile(nm1);
        break;
    case '5':
        cout << "Enter file/folder name to search: ";
        cin >> nm1;
        {
            char loc[1024];
            getcwd(loc, sizeof(loc));
            cout << "Searching in: " << loc << endl;
            findFile(loc, nm1);
        }
    }
}

```

```

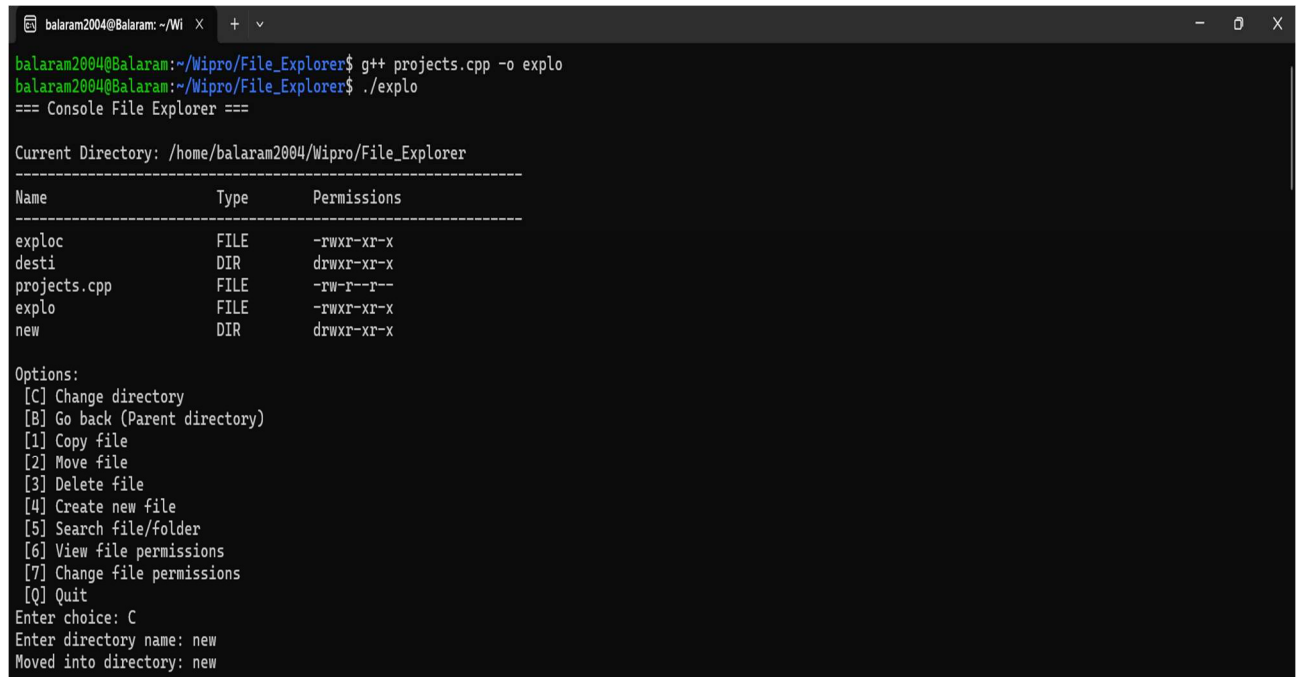
        }
        break;
    case '6':
        cout << "Enter filename to view permissions: ";
        cin >> nm1;
        seePerm(nm1);
        break;
    case '7':
        cout << "Enter filename to change permissions: ";
        cin >> nm1;
        cout << "Enter new permissions (like rwxr-xr--): ";
        cin >> nm2;
        setPerm(nm1, nm2);
        break;
    case 'Q': case 'q':
        cout << "Exiting File Explorer. Goodbye!\n";
        return 0;
    default:
        cout << "Invalid choice! Try again.\n";
    }
}
}

```

11. Output Screenshots

Below are placeholders for screenshots demonstrating each functionality. Insert the images in the boxes and resize as needed.

1. Change Directory (C)

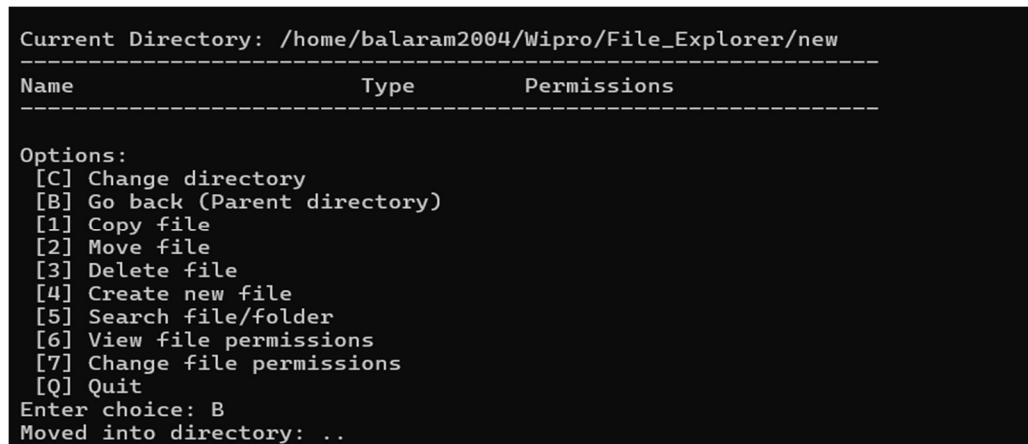


```
balaram2004@Balaram: ~/Wi X + v
balaram2004@Balaram:~/Wipro/File_Explorer$ g++ projects.cpp -o explo
balaram2004@Balaram:~/Wipro/File_Explorer$ ./explo
=== Console File Explorer ===

Current Directory: /home/balaram2004/Wipro/File_Explorer
-----
Name                Type      Permissions
-----
exploc              FILE     -rwxr-xr-x
desti               DIR      drwxr-xr-x
projects.cpp        FILE     -rw-r--r--
explo               FILE     -rwxr-xr-x
new                 DIR      drwxr-xr-x

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: C
Enter directory name: new
Moved into directory: new
```

2. Go Back (B)



```
Current Directory: /home/balaram2004/Wipro/File_Explorer/new
-----
Name                Type      Permissions
-----

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: B
Moved into directory: ..
```

3. Copy File (1)

```
Current Directory: /home/balaram2004/Wipro/File_Explorer
-----
Name                Type      Permissions
-----
HELLO                FILE      -rw-r--r--
exploc               FILE      -rwxr-xr-x
desti                DIR       drwxr-xr-x
projects.cpp         FILE      -rw-r--r--
explo                FILE      -rwxr-xr-x
new                  DIR       drwxr-xr-x

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: 1
Enter source filename: HELLO
Enter destination filename: NEW
File copied successfully!
```

4. Move File (2)

```

Current Directory: /home/balaram2004/Wipro/File_Explorer
-----
Name                Type                Permissions
-----
NEW                 FILE                -rw-r--r--
HELLO               FILE                -rw-r--r--
exploc              FILE                -rwxr-xr-x
desti               DIR                 drwxr-xr-x
projects.cpp        FILE                -rw-r--r--
explo               FILE                -rwxr-xr-x
new                 DIR                 drwxr-xr-x

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: 2
Enter source filename: HELLO
Enter destination filename: NEW
File moved successfully!

```

5. Delete File (3)

```

Current Directory: /home/balaram2004/Wipro/File_Explorer
-----
Name                Type                Permissions
-----
NEW                 FILE                -rw-r--r--
exploc              FILE                -rwxr-xr-x
desti               DIR                 drwxr-xr-x
projects.cpp        FILE                -rw-r--r--
explo               FILE                -rwxr-xr-x
new                 DIR                 drwxr-xr-x

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: 3
Enter filename to delete: NEW
File deleted successfully!

```

6. Create New File (4)

Current Directory: /home/balaram2004/Wipro/File_Explorer

Name	Type	Permissions
exploc	FILE	-rwxr-xr-x
desti	DIR	drwxr-xr-x
projects.cpp	FILE	-rw-r--r--
explo	FILE	-rwxr-xr-x
new	DIR	drwxr-xr-x

Options:

- [C] Change directory
- [B] Go back (Parent directory)
- [1] Copy file
- [2] Move file
- [3] Delete file
- [4] Create new file
- [5] Search file/folder
- [6] View file permissions
- [7] Change file permissions
- [Q] Quit

Enter choice: 4

Enter new filename: HELLO

File created successfully: HELLO

7. Search File/Folder (5)

Current Directory: /home/balaram2004/Wipro/File_Explorer

Name	Type	Permissions
HELLO	FILE	-rw-r--r--
exploc	FILE	-rwxr-xr-x
desti	DIR	drwxr-xr-x
projects.cpp	FILE	-rw-r--r--
explo	FILE	-rwxr-xr-x
new	DIR	drwxr-xr-x

Options:

- [C] Change directory
- [B] Go back (Parent directory)
- [1] Copy file
- [2] Move file
- [3] Delete file
- [4] Create new file
- [5] Search file/folder
- [6] View file permissions
- [7] Change file permissions
- [Q] Quit

Enter choice: 5

Enter file/folder name to search: HELLO

Searching in: /home/balaram2004/Wipro/File_Explorer

Found: /home/balaram2004/Wipro/File_Explorer/HELLO

8. View File Permissions (6)

```

Current Directory: /home/balaram2004/Wipro/File_Explorer
-----
Name                Type                Permissions
-----
HELLO                FILE                -rw-r--r--
exploc               FILE                -rwxr-xr-x
desti                DIR                 drwxr-xr-x
projects.cpp         FILE                -rw-r--r--
explo                FILE                -rwxr-xr-x
new                  DIR                 drwxr-xr-x

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: 6
Enter filename to view permissions: HELLO
Permissions for HELLO: -rw-r--r--

```

9. Change File Permissions (7)

```

Current Directory: /home/balaram2004/Wipro/File_Explorer
-----
Name                Type                Permissions
-----
HELLO                FILE                -rw-r--r--
exploc               FILE                -rwxr-xr-x
desti                DIR                 drwxr-xr-x
projects.cpp         FILE                -rw-r--r--
explo                FILE                -rwxr-xr-x
new                  DIR                 drwxr-xr-x

Options:
[C] Change directory
[B] Go back (Parent directory)
[1] Copy file
[2] Move file
[3] Delete file
[4] Create new file
[5] Search file/folder
[6] View file permissions
[7] Change file permissions
[Q] Quit
Enter choice: 7
Enter filename to change permissions: HELLO
Enter new permissions (like rwxr-xr--): rwxr-xr--
Permissions updated successfully!

```

10. Quit Program (Q)

Current Directory: /home/balaram2004/Wipro/File_Explorer

Name	Type	Permissions
HELLO	FILE	-rwxr-xr--
exploc	FILE	-rwxr-xr-x
desti	DIR	drwxr-xr-x
projects.cpp	FILE	-rw-r--r--
explo	FILE	-rwxr-xr-x
new	DIR	drwxr-xr-x

Options:

- [C] Change directory
- [B] Go back (Parent directory)
- [1] Copy file
- [2] Move file
- [3] Delete file
- [4] Create new file
- [5] Search file/folder
- [6] View file permissions
- [7] Change file permissions
- [Q] Quit

Enter choice: Q

Exiting File Explorer. Goodbye!

balaram2004@Balaram:~/Wipro/File_Explorer\$ |