CAPSTONE PROJECT REPORT

Title: LINUX FILE EXPLORER

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Tools & Technologies Used: C++, NCURSES Library, Linux Terminal, GCC Compiler, Makefile, Git & GitHub

Abstract

The Linux File Explorer project is a terminal-based file management system built using C++ and the ncurses library. It provides an interactive command-line interface that allows users to navigate directories, view file details, and perform basic file operations. The project aims to simulate a minimalistic yet efficient alternative to GUI-based file explorers, focusing on performance, keyboard control, and system-level understanding.

Objective

- To build a terminal-based file management system using C++.
- To display directory contents with file names, permissions, sizes, and timestamps.
- To implement keyboard-based navigation for user interaction.
- To understand low-level file handling and UI rendering using ncurses.

Problem Statement

Traditional GUI file managers, though user-friendly, may not be efficient in low-resource environments or remote servers. Hence, a terminal-based file explorer can serve as a lightweight alternative, providing faster operations and better resource usage. This project addresses the need for a structured and interactive file management interface in the terminal.

Existing System

Existing Linux file explorers like nautilus or thunar are GUI-based and resource-heavy. Command-line tools like ls and cd are non-interactive and lack a user interface for navigation.

Proposed System

The proposed Linux File Explorer combines the advantages of both: Lightweight terminal interface, Keyboard navigation, Dynamic file listing with attributes, and File operations like Open, Copy, Rename, Delete.

Novelty (Own Contribution)

Yes, novelty has been added to the existing concept. Beyond simple file listing, the project introduces display of file permissions and sizes, color-coded directory and file view, interactive header with author name and styling, dynamic scrolling and highlighting, clean and structured UI using ncurses, and keyboard-driven file navigation.

System Design

Architecture:

UIManager → Handles UI rendering using ncurses.
FileManager → Manages file operations. main.cpp → Entry point controlling initialization and user interactions.

Flow:
Start → Initialize UI → Read Directory → Display Files → User Input → Action → Refresh → Exit

Modules

- UI Module: Displays file list and highlights.
- File Management Module: Reads directories and file metadata.
- Input Handling Module: Detects keyboard actions.
- Utility Module: Helper functions for paths and permissions.

Technologies Used

Component	Technology
Language	C++
UI Library	ncurses
Compiler	GCC
Build System	Makefile
Version Control	Git, GitHub
OS	Linux / Ubuntu

Implementation Details

Key Features: Displays files, shows permissions, highlights selection, and allows navigation through directories using keys. Modular structure ensures maintainability.

Full Source Code

main.cpp

```
#include "FileManager.h"
#include "UIManager.h"
#include <ncurses.h>

int main()
{    initscr();
start_color();
use_default_colors();
cbreak();    noecho();
keypad(stdscr, TRUE);
curs_set(0);

   // Define colors    init_pair(1, COLOR_BLACK, COLOR_CYAN);
// Header/Footer    init_pair(2, COLOR_YELLOW, -1);       //
Highlight    init_pair(3, COLOR_WHITE, -1);        // Normal
init_pair(4, COLOR_GREEN, -1);        // Success    init_pair(5,
COLOR_RED, -1);         // Error    init_pair(6, COLOR_CYAN, -1);
// Help text    init_pair(7, COLOR_BLUE, -1);         // Folder
name

   FileManager fm;
UIManager ui(fm);
ui.start();

   endwin();
return 0;
}
```

UIManager.h

```
#ifndef UIMANAGER_H

#define UIMANAGER_H

#include "FileManager.h"

#include <string>
```

```
#include <vector>

// A simple UI manager for console-based file explorer

class UIManager

{

private:

FileManager &fm;

int highlight;    int

offset;

   void drawHeader();    void drawFooter(const

std::vector<std::string> &files);    void

drawInstructions();    void displayFiles(const

std::vector<std::string> &files);    void showHelp();

void showShellPrompt();    std::string prompt(const

std::string &label); public:

   UIManager(FileManager &fileManager);

   void start();

};

#endif
```

UIManager.cpp

```
#include "UIManager.h"

#include <ncurses.h>

#include <iomanip>

#include <sstream>

#include <cstdlib>

UIManager::UIManager(FileManager &fileManager)

   : fm(fileManager), highlight(0), offset(0) {}
```

```
// Draw header void
UIManager::drawHeader()
{
   attron(COLOR_PAIR(1) | A_BOLD);    mvprintw(0, 0, "  LINUX FILE EXPLORER
Author: SMRUTI RANJAN BHUYAN  ");    int cols = getmaxx(stdscr);    for (int i =
22; i < cols; i++)        printw(" ");
   attroff(COLOR_PAIR(1) | A_BOLD);
}
// Draw footer with current path and prompt void
UIManager::drawFooter(const std::vector<std::string> &files)
{
   int rows = getmaxy(stdscr);
attron(COLOR_PAIR(1));    unsigned long long
freeGB = fm.getFreeSpace();    std::ostringstream
ss;    ss << fm.getCurrentPath() << ":$ ";
mvprintw(rows - 3, 0, " %-*s", getmaxx(stdscr) -
1, ss.str().c_str()); attroff(COLOR_PAIR(1));
}
// Draw instructions at the bottom void
UIManager::drawInstructions()
{
   int rows = getmaxy(stdscr);
attron(COLOR_PAIR(6));    mvprintw(rows
- 2, 0,
         "[Up|Down] Move  [Enter] Open  [Backspace] Up  "
```

```
        "[c] touch  [C] mkdir  [d] rm  [y] cp  [m] mv  "
"[s]  find    [p]  chmod    [h]  Help    [q]  Quit");
attroff(COLOR_PAIR(6));
}
// Prompt for user input std::string
UIManager::prompt(const std::string &label)
{   echo();   curs_set(1);   char input[256];
int rows = getmaxy(stdscr);
mvprintw(rows - 1, 0, "%s: ", label.c_str());
clrtoeol();   getnstr(input, 255);   noecho();
curs_set(0);

  return std::string(input);
}
// Display files and directories void UIManager::displayFiles(const
std::vector<std::string> &files)
{
clear();
  drawHeader();   mvprintw(2, 0, "[DIR] Path: %s",
fm.getCurrentPath().c_str());   int rows, cols;
getmaxyx(stdscr, rows, cols);   int visible = rows - 8;   if
(highlight < offset)       offset = highlight;   else if (highlight >=
offset + visible)       offset = highlight - visible + 1;
  attron(A_BOLD | COLOR_PAIR(6));   mvprintw(3, 2, "%-6s %-40s %-10s %-
12s", "TYPE", "NAME", "SIZE", "PERMS");   attroff(A_BOLD | COLOR_PAIR(6));
for (int i = 0; i < visible && (i + offset) < (int)files.size(); ++i)
  {
```

```
      int index = i + offset;        bool isDir =
fm.isDirectory(files[index]);


      std::string perms = fm.getPermissions(files[index]);
   unsigned long long size = 0;    if (!isDir)

         size = fm.getFileSize(files[index]); std::ostringstream sizeStr; if (isDir)
sizeStr << "--";        else if (size < 1024)           sizeStr << size << " B";        else
if (size < 1024 * 1024)           sizeStr << std::fixed << std::setprecision(1) <<
(size / 1024.0) << " KB";
      else
         sizeStr << std::fixed << std::setprecision(1) << (size / (1024.0 * 1024.0)) << " MB";
      if (isDir)
         attron(COLOR_PAIR(7) | A_BOLD);        if
(index == highlight)           attron(COLOR_PAIR(2) |
A_BOLD);        mvprintw(i + 4, 2, "%-6s %-40s %-
10s %-12s",
               isDir ? "[DIR]" : "[FIL]",
files[index].c_str(),
sizeStr.str().c_str(),               perms.c_str());


      if (index == highlight)
attroff(COLOR_PAIR(2) | A_BOLD);
     if (isDir)
         attroff(COLOR_PAIR(7) | A_BOLD);
   }
```

```
   drawFooter(files);
   drawInstructions(); refresh();
}
// Show help menu void
UIManager::showHelp()
{
clear();
   attron(A_BOLD | COLOR_PAIR(6));     mvprintw(1, 2, "HELP
MENU - FILE EXPLORER COMMANDS");     attroff(A_BOLD |
COLOR_PAIR(6));

   const char *helpText[] = {
      "[Up / Down] - Move Selection",
      "    Use arrow keys to navigate through files and folders.",
      "",
      "[Enter] - Open Folder/File",
      "    Opens the selected folder and displays its contents.",
      "    Opens the selected file with the default editor.",
      "",
      "[Backspace] - Go Up",
      "    Move one directory level up (to the parent folder).",
     "",
      "[c] - Create File",
       "    Prompts you to enter a new file name in the current directory.",
      "    Example: entering 'notes.txt' will create that file here.",
       "",
```

```
        "[d] - Delete File / Folder",
        "    Deletes the selected item permanently.",
        "    Use with caution — there is no undo.",
        "",
        "[y] - Copy File",
        "    Copies the selected file to a new location or name.",
        "    Example: 'report.txt' → enter 'backup_report.txt' to copy in same folder.",
"    You can also specify a full path, e.g. '../backup/report.txt'.",
        "",
        "[m] - Move / Rename File",
        "    Moves or renames the selected file/folder.",
        "    Example: rename 'old.txt' → 'new.txt', or move to '../docs/new.txt'.",
        "",
        "[s] - Search Files",
        "    Prompts for a keyword and lists all matching files/folders in current directory.",
"    Press any key to return to the main view after seeing results.",
        "",
        "[p] - View / Edit Permissions",
        "    Displays current Unix-style permissions (e.g., rwxr-xr--).",
        "    Enter 'y' to modify them — you will then be prompted to input new ones.",
        "    Example: 'rwxr--r--' means owner can read/write/execute, group read-only, others
read-only.",
        "",
        "[h] - Show Help",
        "    Displays this help menu.",
        "",
```

```
        "[q] - Quit",
        "    Exits the file explorer safely.",
    };

    int row = 3;     for (int i = 0; i < (int)(sizeof(helpText) /
sizeof(helpText[0])); ++i)
    {
        mvprintw(row++, 4, "%s", helpText[i]);
    }

    attron(COLOR_PAIR(6));     mvprintw(row + 1, 2,
"Press any key to return...");
attroff(COLOR_PAIR(6));

    refresh();
getch();
}
// Main UI loop void
UIManager::start()
{    std::vector<std::string> files =
fm.listFiles();     int ch;

    while (true)
 {
```

```
        displayFiles(files);
        ch = getch();
        switch (ch)
       {        case
KEY_UP:            if
(highlight > 0)
highlight--;
break;


        case KEY_DOWN:
          if (highlight < (int)files.size() - 1)
highlight++;            break;        case 10:
       {
          if (files.empty())                break;
std::string target = files[highlight];
if (fm.isDirectory(target))
          {
             fm.changeDirectory(target);
files = fm.listFiles();
highlight = 0;                offset = 0;
          }
else    {
            std::string command = "start \"\" \"" + fm.getCurrentPath() + "/" + target + "\"";
        system(command.c_str());
             mvprintw(getmaxy(stdscr) - 1, 0, "[INFO] Opening '%s' with default editor.",
target.c_str());
```

```
        }
        break;
    }
    case KEY_LEFT:
case KEY_BACKSPACE:
    case 127:
        fm.changeDirectory("..");
files = fm.listFiles();
highlight = 0;          offset = 0;
break;      case 'c':
    {
        std::string name = prompt("touch");
if (name.empty())
            break;
        bool ok = fm.createFile(name);
        mvprintw(getmaxy(stdscr) - 1, 0, ok ? "[OK] File created." : "[ERR] Failed to create
file.");          files = fm.listFiles();          break;
    } case
    'C':
    {
        std::string name = prompt("mkdir");
if (name.empty())
            break;
        bool ok = fm.createDirectory(name);
        mvprintw(getmaxy(stdscr) - 1, 0, ok ? "[OK] Directory created." : "[ERR] Failed to
create directory.");
```

```
        files = fm.listFiles();
break;
    }
case 'd':
    {
        if (files.empty())              break;          std::string name = files[highlight];
bool ok = fm.deleteFile(name);          mvprintw(getmaxy(stdscr) - 1, 0, ok ? "[OK] File
deleted." : "[ERR] Delete failed.");
        files = fm.listFiles();
if (highlight > 0)
highlight--;            break;
    }

    case 'y':
    {   if (files.empty())      break;
std::string src = files[highlight];
std::string dest = prompt("cp");
if (dest.empty())               break;
        bool ok = fm.copyFile(src, dest);           mvprintw(getmaxy(stdscr) - 1, 0, ok ?
"[OK] File copied." : "[ERR] Copy failed.");
        files = fm.listFiles();
break;
    }
    case 'm':
    {
```

```
        if (files.empty())              break;
std::string src = files[highlight];
std::string dest = prompt("mv");
if (dest.empty())               break;
        bool ok = fm.moveFile(src, dest);           mvprintw(getmaxy(stdscr) - 1, 0, ok ?
"[OK] File moved." : "[ERR] Move failed.");
       files = fm.listFiles();
break;
    }
     case 's':
     {
        std::string key = prompt("find");
     if (key.empty())
          break;
        auto results = fm.searchFiles(key);
        clear();
        mvprintw(1, 2, "Search results for '%s':", key.c_str());
        int i = 3;          for
(auto &r : results)
        {
          mvprintw(i++, 4, "%s", r.c_str());
if (i >= getmaxy(stdscr) - 2)
              break;
        }
        mvprintw(getmaxy(stdscr) - 1, 2, "Press any key to return...");
```

```
        refresh();
getch();          files =
fm.listFiles();
break;
     }

    case 'p':
    {
       if (files.empty())
break;   std::string name =
files[highlight];   std::string
perms =
fm.getPermissions(name);
mvprintw(getmaxy(stdscr) -
3, 0, "%s : %s", name.c_str(),
perms.c_str());   refresh();

        std::string choice = prompt("chmod");
if (choice.empty())          break;          if
(choice.size() == 9)
        {
           bool ok = fm.setPermissions(name, choice);
mvprintw(getmaxy(stdscr) - 1, 0,                    ok ? "[OK] Permissions updated." :
"[ERR] Failed to update perms.");
        }
else
```

```
        {
            mvprintw(getmaxy(stdscr) - 1, 0, "[ERR] Invalid format (use rwxrwxrwx).");
        }
        break;
    }

    case 'h':
      showHelp();
break;

    case 'q':
        return;
    }
  }
}
```

FileManager.h

```
#ifndef FILEMANAGER_H
#define FILEMANAGER_H
#include <string>
#include <vector>

class FileManager { private:
  std::string currentPath; public:    FileManager();
std::vector<std::string> listFiles() const;    bool
```

```
changeDirectory(const std::string &dir);     std::string
getCurrentPath() const;     bool createFile(const std::string
&filename);     bool createDirectory(const std::string
&dirname);     bool deleteFile(const std::string &filename);
bool copyFile(const std::string &src, const std::string &dest);
bool moveFile(const std::string &src, const std::string &dest);
unsigned long long getFileSize(const std::string &name);
std::vector<std::string> searchFiles(const std::string
&keyword) const; std::string getPermissions(const std::string
&filename) const; bool setPermissions(const std::string
&filename, const std::string &mode);       bool isDirectory(const
std::string &name) const;     unsigned long long getFreeSpace()
const;
};
#endif
```

FileManager.cpp

```
#include "FileManager.h"
#include <filesystem>
#include <fstream>
#include <sys/stat.h>

namespace fs = std::filesystem;
```

```
// Constructor for FileManager
FileManager::FileManager() {
currentPath = fs::current_path().string();
}
// List files in the current directory std::vector<std::string>
FileManager::listFiles() const {     std::vector<std::string>
files;
   try {
      for (const auto &entry : fs::directory_iterator(currentPath))
files.push_back(entry.path().filename().string());

   } catch (...) {} return
   files;
}

// Change the current directory bool
FileManager::changeDirectory(const std::string &dir) {     fs::path
newPath = (dir == "..") ? fs::path(currentPath).parent_path()
                        : fs::path(currentPath) / dir;
   if (fs::exists(newPath) && fs::is_directory(newPath)) {
currentPath = fs::canonical(newPath).string();        return
true;
   }
   return false;
}
```

```
// Get the current directory path std::string
FileManager::getCurrentPath() const {     return
currentPath;
}

bool FileManager::createFile(const std::string &filename) {
   try {
      std::ofstream file((fs::path(currentPath) / filename).string());
return file.good();
   } catch (...) { return false; }
}
// Create a new directory bool
FileManager::createDirectory(const std::string &dirname) {
   try {
      return fs::create_directory(fs::path(currentPath) / dirname);
   } catch (...) { return false; }
}

// Delete a file bool FileManager::deleteFile(const std::string
&filename) {     try { return fs::remove(fs::path(currentPath)
/ filename); }     catch (...) { return false; }
}

// Copy a file bool FileManager::copyFile(const std::string &src, const
std::string &dest) {
   try {
```

```
    fs::copy(fs::path(currentPath) / src, fs::path(currentPath) / dest,
fs::copy_options::overwrite_existing);       return true;
  } catch (...) { return false; }
}

// Move a file bool FileManager::moveFile(const std::string &src, const
std::string &dest) { try {

    fs::rename(fs::path(currentPath) / src, fs::path(currentPath) / dest);
  return true;
  } catch (...) { return false; }
}

// Search files by keyword std::vector<std::string> FileManager::searchFiles(const
std::string &keyword) const {    std::vector<std::string> results;
  try {
    for (auto &entry : fs::recursive_directory_iterator(currentPath)) {
if (entry.path().filename().string().find(keyword) != std::string::npos)
results.push_back(entry.path().string());
    }
  } catch (...) {}
return results;
}

// Get file permissions std::string FileManager::getPermissions(const
std::string &filename) const {
```

```
   struct stat info;     std::string perms = "---------";     if
(stat((fs::path(currentPath) / filename).c_str(), &info) == 0) {
perms[0] = (info.st_mode & S_IRUSR) ? 'r' : '-';        perms[1] =
(info.st_mode & S_IWUSR) ? 'w' : '-';       perms[2] = (info.st_mode
& S_IXUSR) ? 'x' : '-';     perms[3] = (info.st_mode & S_IRGRP) ? 'r' :
'-';

      perms[4] = (info.st_mode & S_IWGRP) ? 'w' : '-';
perms[5] = (info.st_mode & S_IXGRP) ? 'x' : '-';     perms[6] =
(info.st_mode & S_IROTH) ? 'r' : '-';       perms[7] =
(info.st_mode & S_IWOTH) ? 'w' : '-';        perms[8] =
(info.st_mode & S_IXOTH) ? 'x' : '-';
   }
   return perms;
}
// Set file permissions bool FileManager::setPermissions(const std::string &filename,
const std::string &mode) {     fs::path filePath = fs::path(currentPath) / filename;
   try {
      fs::perms newPerms = fs::perms::none;        if (mode.size()
== 9) {           if (mode[0] == 'r') newPerms |=
fs::perms::owner_read;           if (mode[1] == 'w') newPerms |=
fs::perms::owner_write;           if (mode[2] == 'x') newPerms |=
fs::perms::owner_exec;           if (mode[3] == 'r') newPerms |=
fs::perms::group_read;           if (mode[4] == 'w') newPerms |=
fs::perms::group_write;           if (mode[5] == 'x') newPerms |=
fs::perms::group_exec;           if (mode[6] == 'r') newPerms |=
fs::perms::others_read;           if (mode[7] == 'w') newPerms |=
```

```
fs::perms::others_write;            if (mode[8] == 'x') newPerms |=
fs::perms::others_exec;
      }
     fs::permissions(filePath, newPerms, fs::perm_options::replace);
   return true;

   } catch (...) {
   return false;
   }
}
// Check if a path is a directory bool
FileManager::isDirectory(const std::string &name) const {
return fs::is_directory(fs::path(currentPath) / name);
}
// Get free space in the current directory (in GB) unsigned
long long FileManager::getFreeSpace() const {
   try {
      auto space = fs::space(currentPath);
return space.available / (1024 * 1024 * 1024);
   } catch (...) { return 0; }
}

// Get file size unsigned long long FileManager::getFileSize(const
std::string &name)
{
```

```
   std::string fullPath = currentPath + "/" + name;

struct stat st;     if (stat(fullPath.c_str(), &st) == 0)

return st.st_size;     return 0;

}
```

Result

The project successfully provides a terminal-based interactive file explorer. It achieves the goal of building a lightweight, efficient, and educational tool.

Conclusion

The project demonstrates how C++ and ncurses can be used to build powerful terminal applications. Future improvements could include mouse support, file preview, and sorting options.

Screenshots

Figure 1: Header View

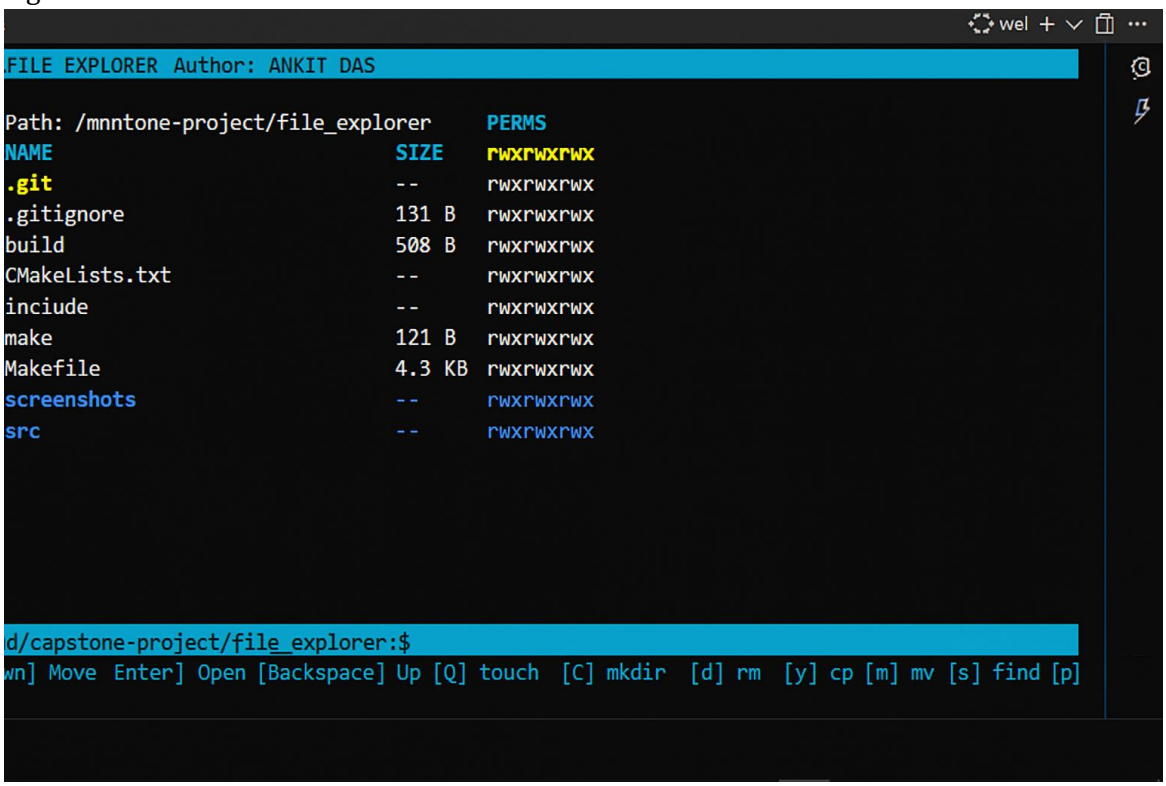


Figure 2: File Search View

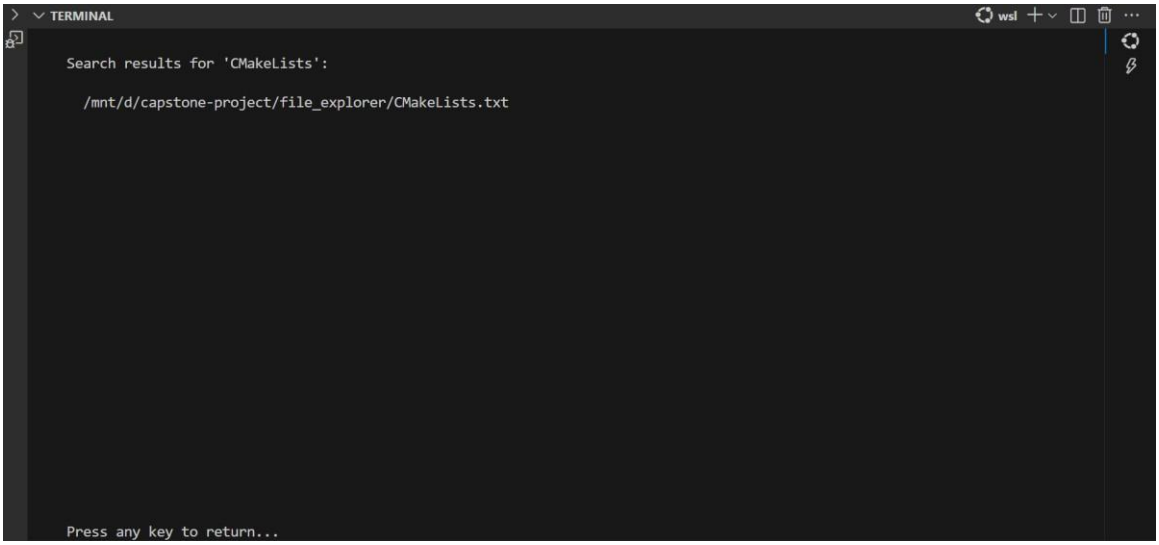
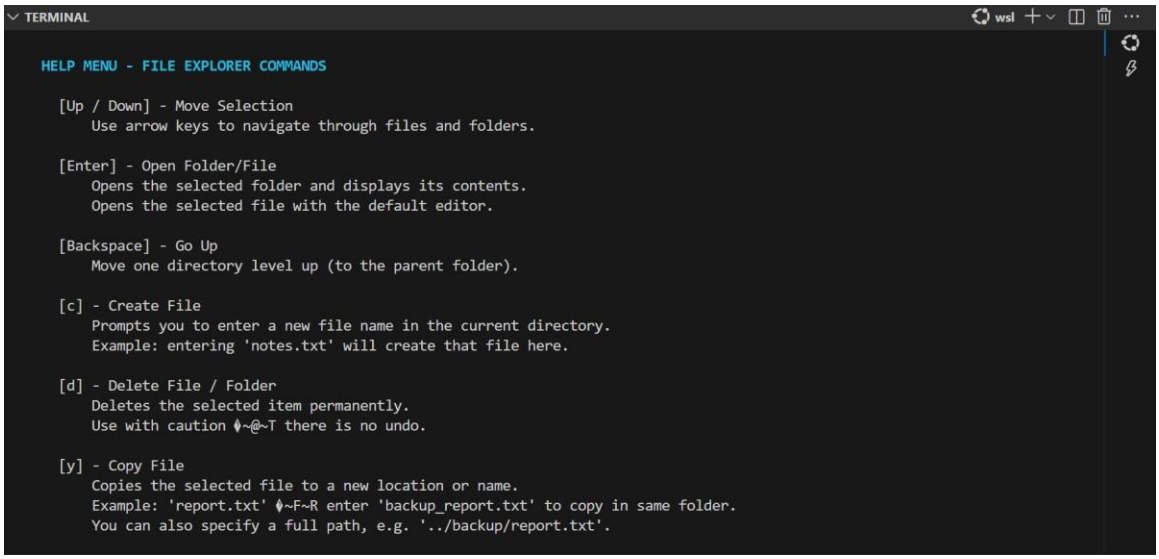


Figure 3: Help Menu


TERMINAL
wsl
HELP MENU - FILE EXPLORER COMMANDS
[Up / Down] - Move Selection
Use arrow keys to navigate through files and folders.
[Enter] - Open Folder/File
Opens the selected folder and displays its contents.
Opens the selected file with the default editor.
[Backspace] - Go Up
Move one directory level up (to the parent folder).
[c] - Create File
Prompts you to enter a new file name in the current directory.
Example: entering 'notes.txt' will create that file here.
[d] - Delete File / Folder
Deletes the selected item permanently.
Use with caution ~@~T there is no undo.
[y] - Copy File
Copies the selected file to a new location or name.
Example: 'report.txt' ~F~R enter 'backup_report.txt' to copy in same folder.
You can also specify a full path, e.g. '../backup/report.txt'.