

File Organizer App: An Automated System Call-Based Approach to Intelligent File System Management

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Abstract—This paper presents the File Organizer App, an advanced Operating Systems engineering project designed to automate and enhance file system management using low-level POSIX system calls. The system combines a high-performance C backend with a Next.js visualization layer to deliver intelligent file classification, workspace virtualization, safe deletion architecture, AI-assisted natural language commands, and collaborative sharing capabilities. By leveraging `dirent.h`, `sys/stat.h`, and atomic file operations, the application ensures efficient directory traversal, metadata tracking, and controlled file manipulation within a sandboxed environment. Experimental results demonstrate the system's ability to transform unstructured directories into organized hierarchies while maintaining safety, scalability, and extensibility across Linux, macOS, and WSL environments.

Index Terms—Operating Systems, System Calls, File Management, C Programming, Next.js, Virtual Workspace, NLP

I. INTRODUCTION

Problem Definition: Modern computing environments experience exponential file growth, leading to cluttered directories and inefficient manual organization.

Project Goal: To develop a system-level file management framework that integrates OS-level operations with modern full-stack and AI capabilities.

Scope: The system supports Linux, macOS, and WSL. It integrates a C backend for file operations and a Next.js frontend for visualization, AI interaction, and collaborative features.

II. LITERATURE REVIEW

Automated file management systems reduce manual cognitive load while improving consistency and efficiency. POSIX-compliant system calls such as `readdir()`, `mkdir()`, and `rename()` provide direct interaction with file systems.

Modern trends demonstrate hybrid architectures combining low-level backends with web-based visualization layers for improved transparency and user interaction.

III. METHODOLOGY

A. System Architecture

The system follows a decoupled architecture:

- **Backend Layer (C):** Handles directory traversal, file classification, metadata tracking, and bin operations.
- **Frontend Layer (Next.js):** Provides visualization, AI command interface, search, tagging, and workspace management.

B. System Calls Used

- `mkdir(2)` – Creates directories
- `readdir(3)` – Iterates directory entries
- `rename(2)` – Atomic file movement
- `stat(2)` – Retrieves file metadata

C. File Classification Logic

TABLE I
FILE CLASSIFICATION LOGIC

File Type	Extensions	Destination Folder
Documents	.txt, .pdf, .docx, .doc, .xlsx, .pptx	Documents/
Images	.jpg, .jpeg, .png, .gif, .bmp, .svg	Images/
Audio	.mp3, .wav, .aac, .flac, .ogg	Audio/
Videos	.mp4, .mkv, .avi, .mov, .wmv	Videos/
Others	All other types	Others/

IV. EXTENDED SYSTEM CAPABILITIES

A. Core File Management Capabilities

The system supports directory creation, renaming, downloading, and batch operations.

Bulk Operations: Multi-selection allows batch move, delete, or download.

File Uploads: Single and batch uploads supported.

Visual Modes:

- List View with metadata columns
- Grid View with thumbnails

B. Safe Deletion and Recovery Architecture (Bin System)

Soft Deletion: Files are redirected to a hidden `.bin` directory.

Metadata Tracking: Each item stores:

- Original path
- Deletion timestamp
- UUID identifier

Permanent Deletion: Irreversible removal available within Bin interface.

C. Advanced Organization and Customization

Workspace Virtualization: Users create isolated sandbox directories called Workspaces.

Dynamic Folder Color Coding: Custom color labels persist even after bin restoration.

Favorites and Tagging: Starred items appear in quick-access panel. Tagging improves retrieval.

D. Intelligent Search and Retrieval

Debounced Live Search: Real-time filtering without excessive backend calls.

Rich Info Panels: Displays size, type, timestamps, and path.

Quick Navigation: Sidebar tracks Recents, Favorites, and Shared items.

E. AI-Assisted File Operations

Natural Language Commands: Plain-language prompts translated into backend operations.

Context-Aware Suggestions: Directory analysis enables intelligent action recommendations.

Multi-Agent Tool Integration: AI orchestrates folder creation, batch movement, and semantic search.

F. Collaboration and Sharing

Secure Link Generation: Unique shareable links for files/folders.

Shared Tracking: Sidebar logs actively shared paths.

V. RESULTS AND DISCUSSION

Testing demonstrated successful:

- Automatic file categorization
- Safe deletion and restoration
- Multi-file batch processing
- AI-driven command execution
- Workspace isolation

The architecture scales effectively across Linux, macOS, and WSL.

A. Visual Results

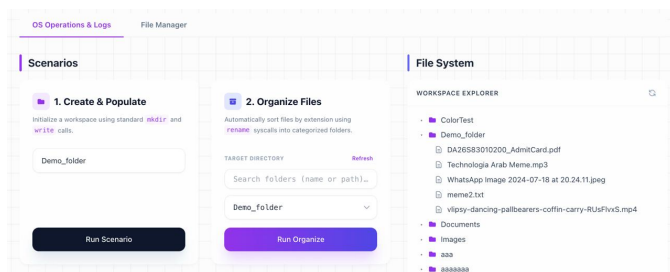


Fig. 1. Initial Unorganized Directory Structure

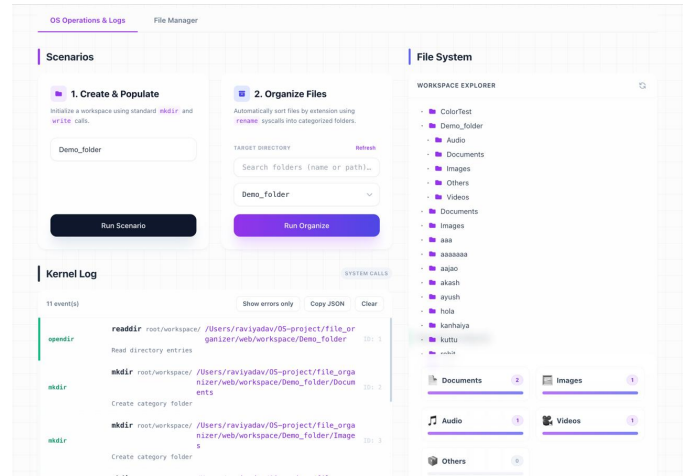


Fig. 2. Organized Directory After Classification

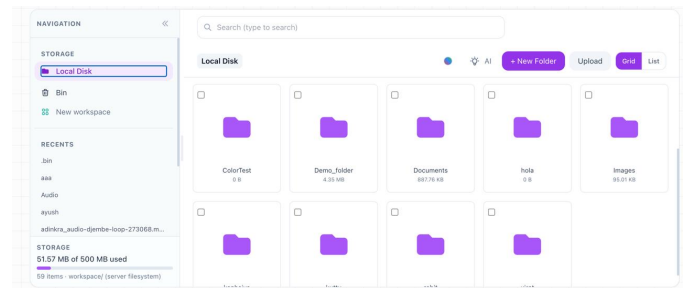


Fig. 3. File Manager Interface

VI. SYSTEM ENHANCEMENT IMPACT

The integration of virtualization, soft-deletion architecture, AI-assisted operations, and collaboration transforms the system from a basic OS utility into a scalable file management framework.

This project demonstrates:

- Practical application of POSIX system calls
- Metadata persistence strategies
- Secure sandbox enforcement
- Human-computer interaction via NLP

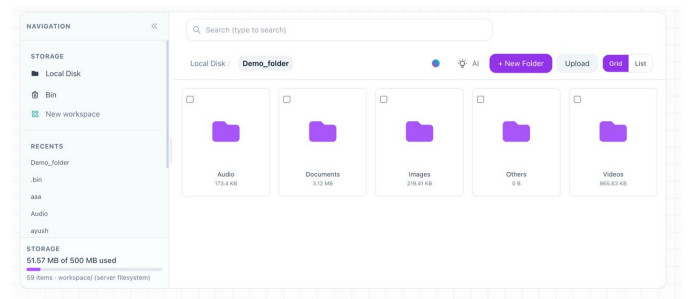


Fig. 4. Organized Folders inside Directory

VII. CONCLUSION AND FUTURE WORK

The File Organizer App successfully bridges low-level system programming with modern full-stack and AI-driven design.

Future Enhancements:

- Recursive multi-depth scanning
- Duplicate detection via hashing
- Role-based access control
- Cloud storage integration
- Machine learning-based file categorization

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