CollabTrack

Version-Controlled File Management for Musicians

A secure platform that brings professional version control to music collaboration, built with cloud technology and data engineering principles.

By Damien Ha

The Problem: File Chaos in Music Collaboration

Musicians face mounting challenges when collaborating remotely:

- Ad-hoc file sharing via email and cloud drives
- Lost versions and ambiguity ("Is this the latest mix?")
- No audit trail or change history
- Incompatible DAW files across platforms

Real musician feedback: "The biggest problems aren't related to technique or art. They're extremely low royalty payments and AI-made music taking away streams from musicians."

The Solution: Secure Data Lifecycle

Single Source of Truth

Centralized platform for all project files with complete version history and traceability

Professional Version Control

Track every change, revert when needed, and maintain clear project evolution

Future: Human Verification

Planned badges to authenticate human-created work in the age of AI

User Journey

Register & Login
Secure authentication with encrypted credentials

Create Project
Establish new collaboration workspace

Upload Version
Add files with automatic versioning
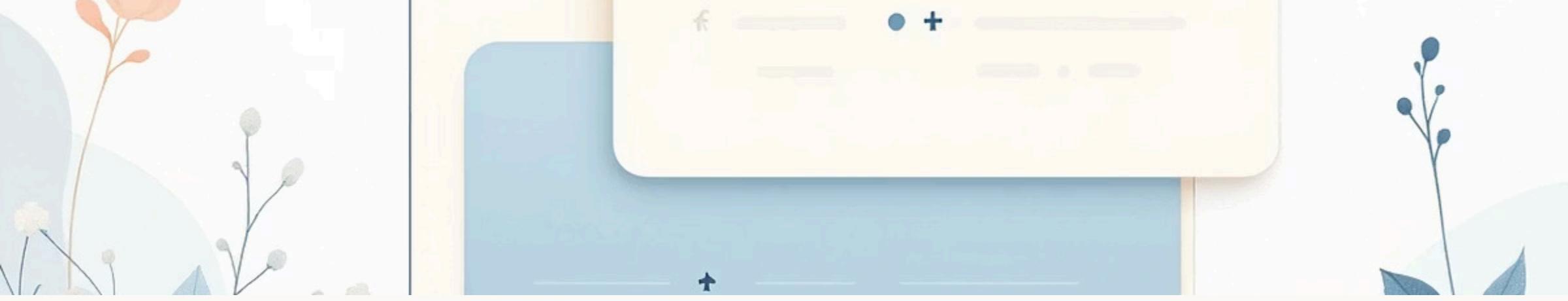
View History
Track all changes and contributors

Download
Secure access to any version

The platform provides an intuitive workflow that replaces chaotic file sharing with systematic tracking, ensuring collaborators always work with the right version.

Three-Tier Architecture

Flask Backend

Python-based application core handling routing, business logic, and user authentication

PostgreSQL Database

Relational storage for user accounts, project metadata, and complete version history

AWS S3 Cloud Storage

Scalable object storage for audio files with secure access control

Database Design & Metadata Strategy
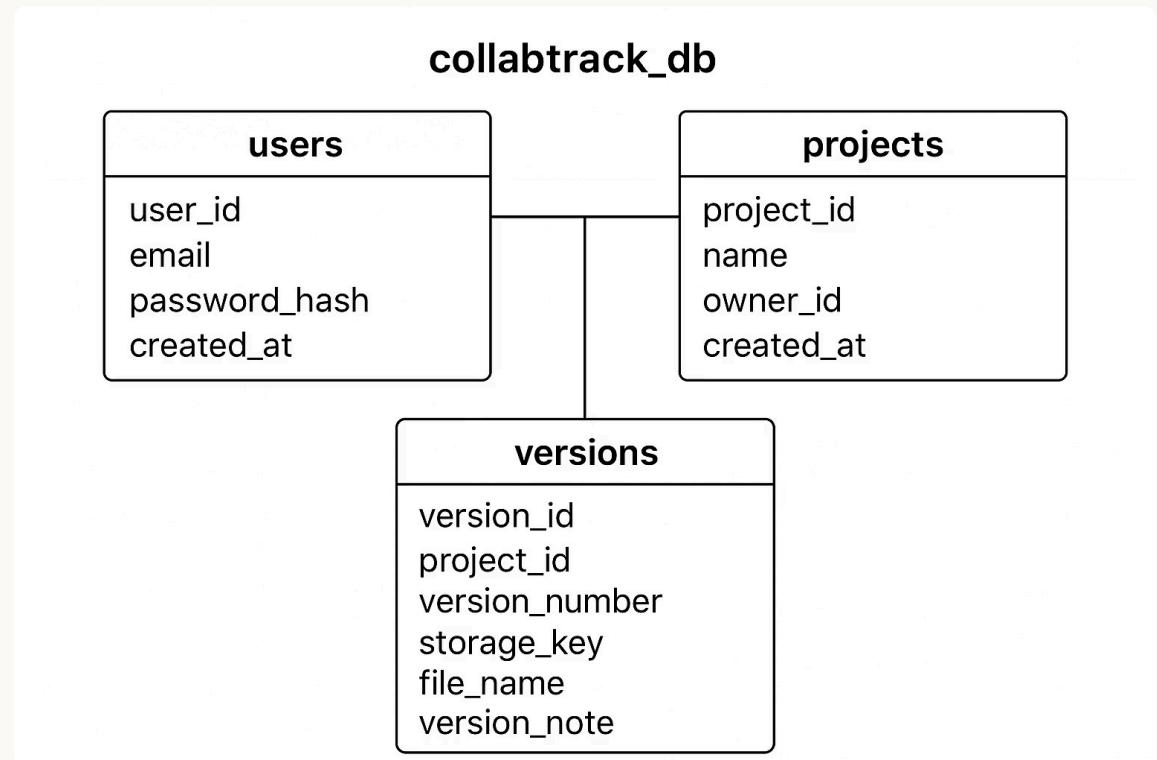
Relational Schema

Users Table: Authentication and profile data
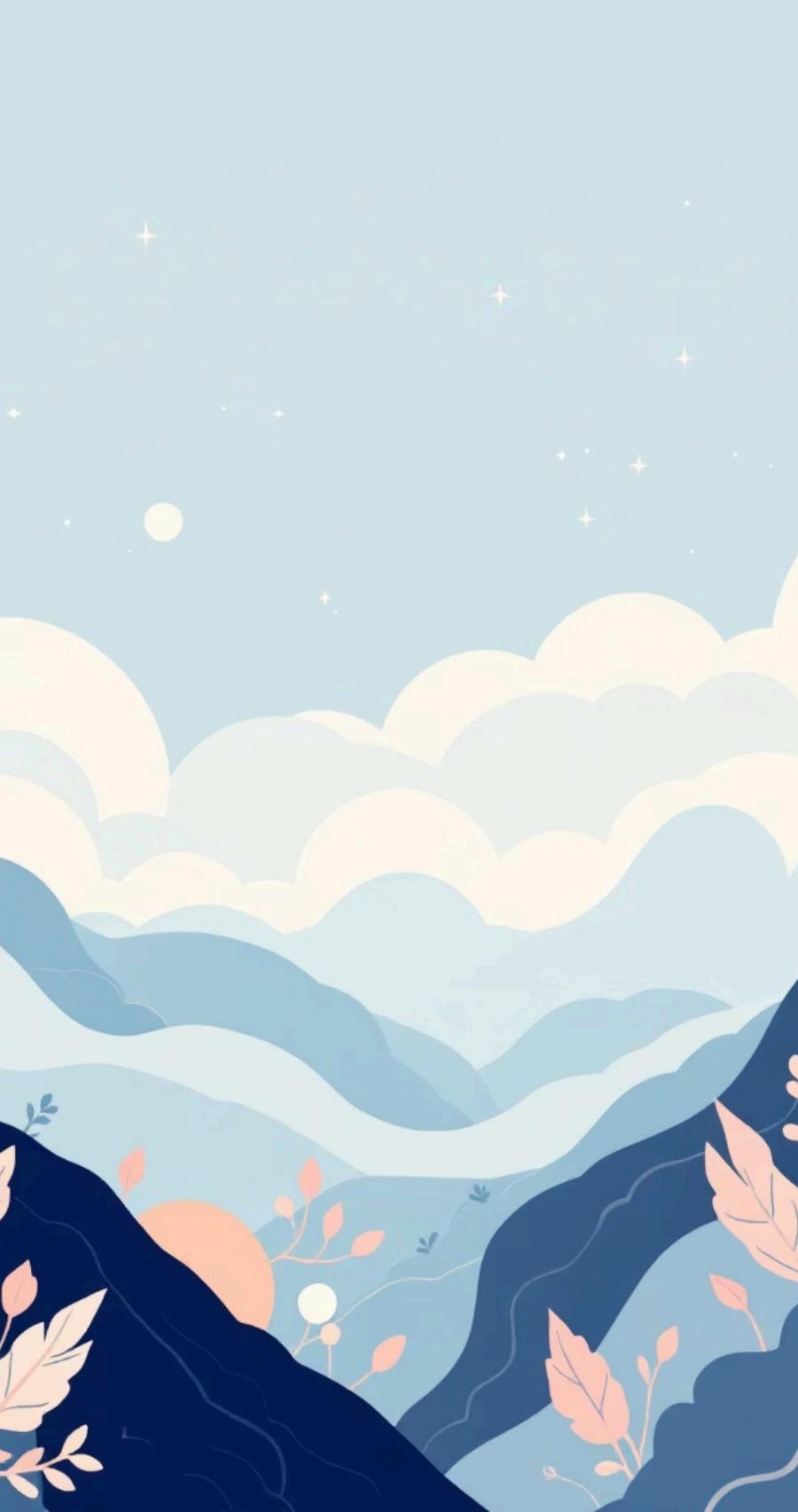
Projects Table: Collaboration workspaces with ownership tracking

Versions Table: The heart of the system

- Sequential version numbering
- S3 storage keys for file retrieval
- Upload timestamps for audit trails
- File metadata (name, size, format)

collabtrack_db

users
- user_id
- email
- password_hash
- created_at

projects
- project_id
- name
- owner_id
- created_at

versions
- version_id
- project_id
- version_number
- storage_key
- file_name
- version_note

This structured approach enables comprehensive version tracking while maintaining data integrity and supporting future features like human verification badges.

Cloud Integration: Secure File Management

01

File Upload

User uploads audio file through Flask application interface

02

Metadata Storage

PostgreSQL records version details, timestamps, and S3 storage key

03

S3 Upload

Boto3 SDK securely transfers file to AWS S3 bucket

04

Secure Download

Pre-signed URLs provide time-limited, authenticated access to files

The pre-signed URL approach ensures files never pass through the application server during download, optimizing performance while maintaining security.

Security Architecture

🔒 Password Protection

Bcrypt hashing ensures passwords are never stored in plain text, protecting user accounts even in breach scenarios

👥 Session Management

Flask sessions with secure cookies maintain authenticated user state across requests

🛡️ Route Protection

Custom @login_required decorator enforces authentication on every sensitive endpoint

🔑 Credential Management

DOTENV keeps AWS keys, database passwords, and secret keys out of version control

MVP Achievement: Full CRUD Lifecycle
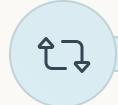
Create

Users create projects and upload files with automatic metadata capture and S3 storage

Read

Dashboard displays user projects and detailed version history for each collaboration

Update

Sequential versioning system tracks file evolution with complete audit trails

Download

Secure pre-signed URLs enable authorized access to any version without compromising security

The complete data lifecycle demonstrates proficiency in database design, cloud architecture, and secure application development—core competencies for modern data engineering.

From Personal Passion to Technical Solution

As a Statistics and Data Science major who played clarinet in UCLA's ensembles, I witnessed firsthand the collision of music and technology challenges.

The Vision: CollabTrack addresses immediate collaboration pain points while preparing for tomorrow's AI challenges through planned human verification features.

Next Steps: Professional Jinja templating, custom error handling, and ultimately—the human verification badge system that will help musicians prove authenticity in an AI-saturated landscape.

GitHub Repository: collabtrack