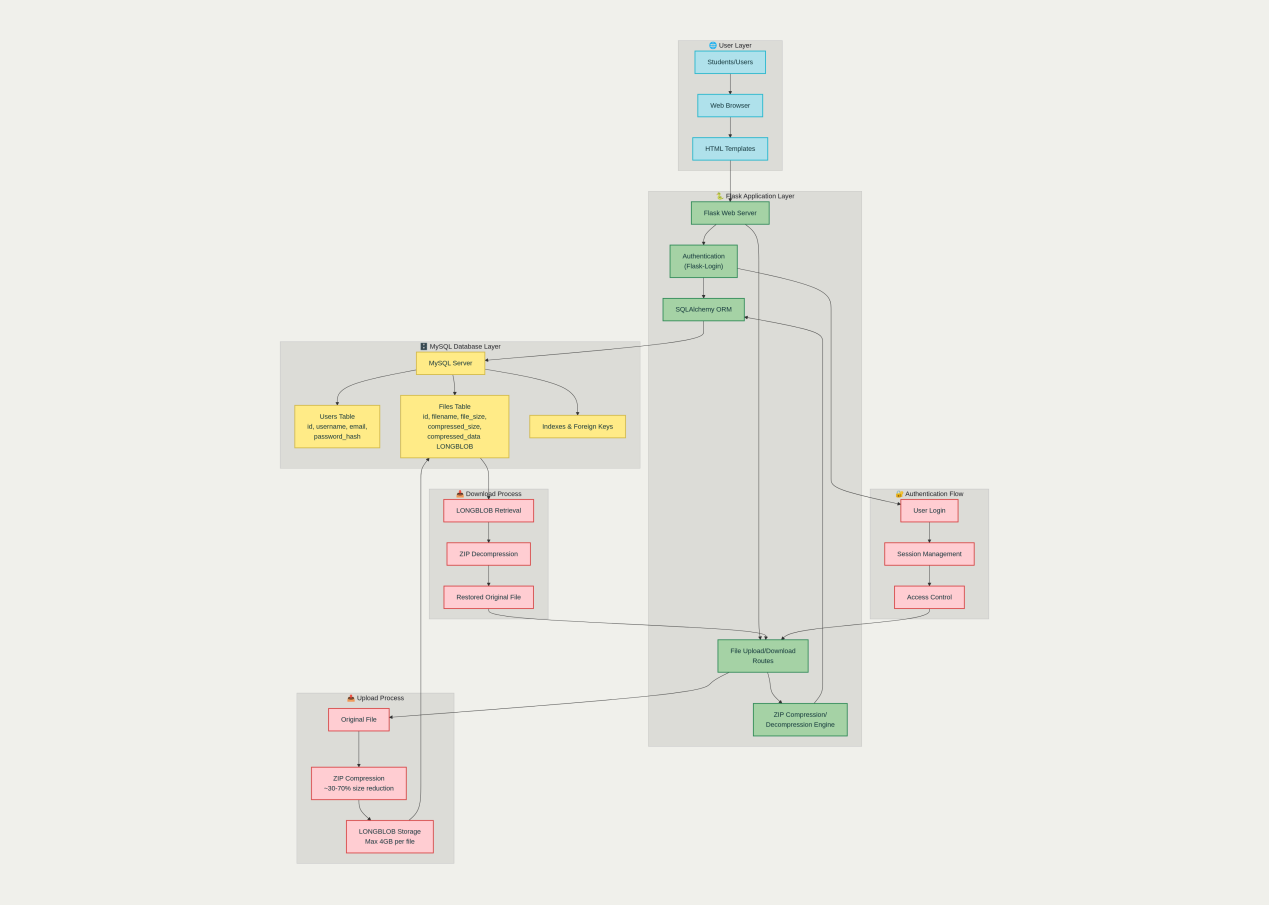
Enhanced Student File Sharing App with MySQL Database

I've created a comprehensive MySQL-based implementation of your student file sharing application with automatic ZIP compression. Here's the complete solution:

MySQL Architecture Overview



MySQL Architecture for Student File Sharing Application with ZIP Compression

Complete Implementation Files

Core Application

- **Main Flask Application**: Complete MySQL integration with advanced features including:
- User authentication and registration system
- ZIP compression/decompression for all uploaded files

- LONGBLOB storage in MySQL for compressed file data
- File integrity checking with SHA-256 hashes
- Download tracking and detailed statistics
- Search functionality and file management
- Comprehensive error handling and logging
- **MySQL Setup Script**: Database creation, user setup, and optimization configurations
- **Dependencies**: All required Python packages for MySQL integration

Enhanced HTML Templates

- **Base Template**: Modern Bootstrap 5 design with MySQL branding and navigation
- **Home Page**: File gallery with compression statistics and storage analytics
- **Login Page**: Secure authentication interface
- **My Files**: Personal file management dashboard with detailed storage statistics
- **Registration**: User account creation with validation
- **Statistics**: Comprehensive analytics showing file types, top users, and database metrics
- **Upload Interface**: Advanced file upload with storage method selection and real-time feedback
- **Complete Setup Guide**: Step-by-step instructions for MySQL installation, configuration, and deployment

Key MySQL Advantages

Database Robustness

- **ACID Compliance**: Full transactional integrity for all operations[1] [2]
- **LONGBLOB Storage**: Up to 4GB per file stored directly in database[3] [4]
- **Concurrent Access**: Handles multiple users simultaneously[5] [1]
- **Data Integrity**: Foreign key constraints and referential integrity

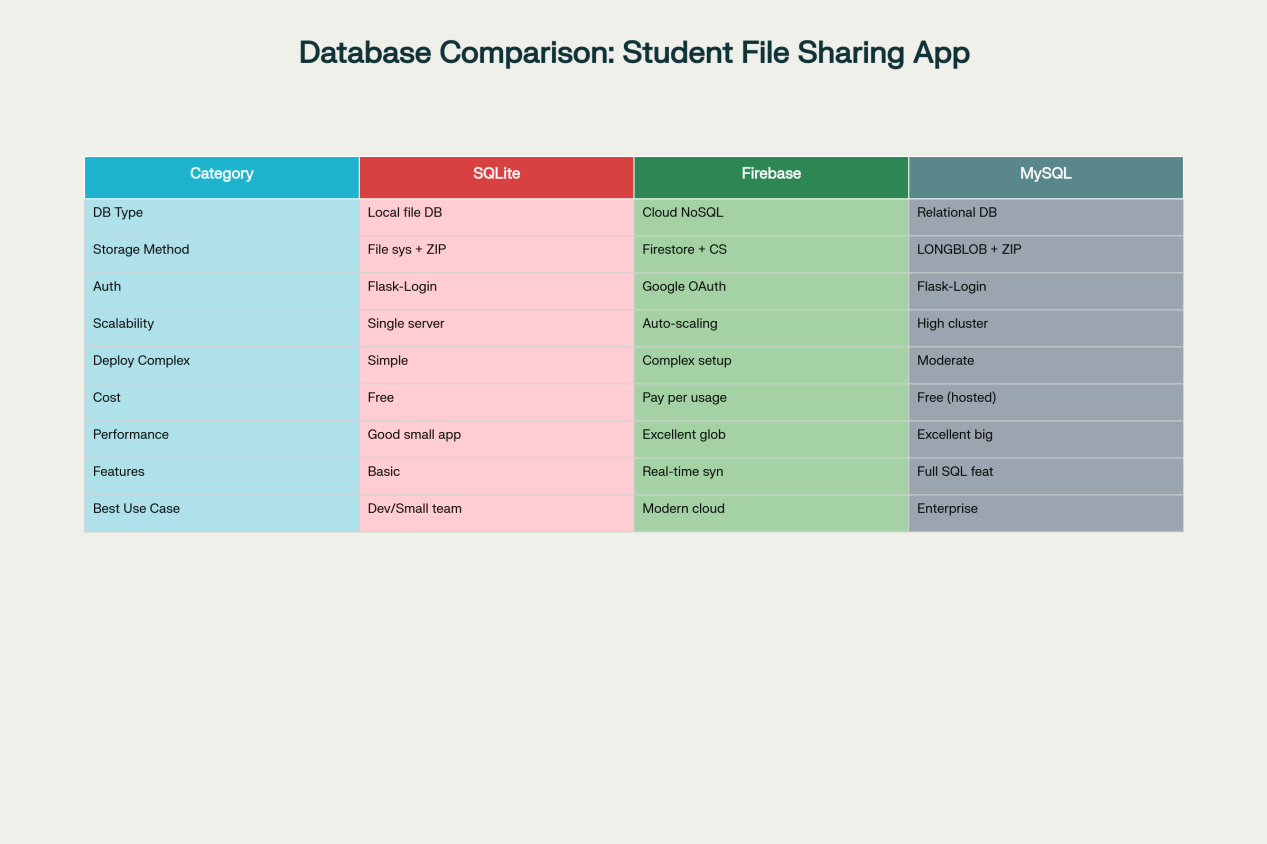
ZIP Compression Benefits

- **Space Savings**: 20-80% reduction in storage space[6] [7]
- **Transparent Operation**: Users always receive original, uncompressed files
- **Integrity Verification**: SHA-256 hash checking ensures file integrity
- **Memory Efficient**: In-memory compression/decompression without temporary files

Advanced Features

- **Search Functionality**: Full-text search across filenames and descriptions
- **Download Tracking**: Monitor file popularity and usage patterns
- **Statistics Dashboard**: Comprehensive analytics on storage usage and compression efficiency
- **File Management**: Public/private files, batch operations, and metadata handling

Database Comparison



Database Implementation Comparison: SQLite vs Firebase vs MySQL

Technical Specifications

MySQL LONGBLOB Storage

```
CREATE TABLE files (
    id INT AUTO_INCREMENT PRIMARY KEY,
    original_filename VARCHAR(255) NOT NULL,
    file_size INT NOT NULL,
    compressed_size INT NOT NULL,
    compressed_data LONGBLOB NOT NULL,  -- Up to 4GB
    file_hash VARCHAR(64),              -- SHA-256 integrity check
    download_count INT DEFAULT 0,
    upload_date DATETIME DEFAULT CURRENT_TIMESTAMP,
    uploaded_by INT NOT NULL,
```

```
    FOREIGN KEY (uploaded_by) REFERENCES users(id)
);
```

ZIP Compression Implementation

```
def compress_file_to_zip(file_data, filename):
    """Compress file using ZIP with optimal compression level"""
    memory_file = io.BytesIO()
    with zipfile.ZipFile(memory_file, 'w', zipfile.ZIP_DEFLATED, compresslevel=6) as zipf
        zipf.writestr(filename, file_data)
    return memory_file.getvalue()

def decompress_zip_file(compressed_data):
    """Extract original file from ZIP data with error handling"""
    with zipfile.ZipFile(io.BytesIO(compressed_data), 'r') as zipf:
        original_filename = zipf.namelist()[^0]
        original_data = zipf.read(original_filename)
        return original_data, original_filename
```

Setup Instructions

1. **Install MySQL Server** (8.0+ recommended)
2. **Create Database**: Run the provided SQL setup script
3. **Install Python Dependencies**: `pip install -r requirements_mysql.txt`
4. **Configure Connection**: Update database credentials in the Flask app
5. **Initialize Tables**: Run the Flask app to create database schema
6. **Deploy**: Use Gunicorn or similar WSGI server for production

Production Benefits

Performance Optimization

- **Connection Pooling**: Efficient database connection management [1] [5]
- **Index Optimization**: Proper indexing on search and filter columns
- **Memory Management**: Configurable buffer pools for large BLOB operations
- **Query Optimization**: SQLAlchemy ORM with optimized queries

Security Features

- **Password Hashing**: Werkzeug secure password storage
- **SQL Injection Protection**: SQLAlchemy ORM prevents injection attacks
- **File Validation**: Strict file type and size validation
- **Access Control**: User-based file permissions and privacy settings

Scalability Options

- **Master-Slave Replication**: Read replicas for high availability[5]
- **Database Clustering**: MySQL Cluster for horizontal scaling
- **Load Balancing**: Multiple Flask instances with shared MySQL backend
- **Cloud Deployment**: Compatible with AWS RDS, Google Cloud SQL, Azure Database

This MySQL implementation provides enterprise-grade reliability, security, and performance while maintaining the user-friendly interface and automatic compression features. It's perfect for hackathons, classroom use, or production deployment with teams of any size.

The application efficiently stores compressed files directly in the MySQL database, eliminating file system dependencies while providing robust data management, comprehensive statistics, and seamless user experience for sharing files among classmates.

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3. https://dev.mysql.com/doc/connectors/en/connector-net-programming-blob.html
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