

University ERP System - Project Summary

Student Name: Mukul & Mayank rana **Course:** Advanced Programming (Java)

1. Project Scope

I developed a comprehensive desktop-based University ERP system using **Java Swing** and **JDBC**. The application streamlines academic management by providing distinct, secure interfaces for Students, Instructors, and Administrators. The system is designed to handle course registration, automated grading, and user management efficiently.

2. Architecture & Security

To strictly adhere to security best practices, the system uses a "**Shadow Database**"

Architecture:

- **Authentication DB (auth_db):** Dedicated solely to security. It stores usernames, roles, and **BCrypt hashed passwords**. Real passwords are never stored.
- **ERP Database (erp_db):** Stores operational data (courses, enrollments, grades).
- **Role Enforcement:** Users are authenticated via the Auth DB, which then grants access *only* to the specific Dashboard authorized for their role (Student, Instructor, or Admin).

3. Key Functionalities

- **Student Module:** Features a responsive Course Catalog. Students can view course details, check real-time seat availability, and enroll in classes. The system automatically prevents duplicate enrollments and blocks registration if a course is full.
- **Instructor Module (Automated Grading):** Instructors can view their assigned sections and enter marks. I implemented an automated logic where the system sums component scores (**Quiz: 20, Midterm: 30, EndSem: 50**) and immediately calculates the Final Letter Grade (A, B, C, etc.).
- **Admin Module & Maintenance Mode:** The Admin serves as the superuser. A critical feature is the "**Maintenance Mode**" toggle. When enabled, it sets a global flag that intercepts and blocks "write" operations (like enrolling or saving grades) from all other users to ensure data integrity during updates.

4. Bonus Features

To enhance the user experience, I integrated several advanced features:

- **Data Visualization:** The Admin Dashboard includes dynamic **Pie Charts** (User Distribution) and **Bar Charts** (Course Popularity).

- **Notifications System:** A dedicated panel for users to receive and view system alerts.
- **Reports & Backup:** A summary window providing a quick snapshot of system statistics.

5. Technical Stack

- **Language:** Java (JDK 21)
- **UI Framework:** Java Swing with FlatLaf for modern styling.
- **Database:** MySQL 8.0 (connected via JDBC).
- **Security:** JBCrypt for password hashing.