

Tools & Techniques for the Student Portal Project

Backend Development (Node.js)

- **Framework:** Express.js
 - **Database:** MongoDB
 - **Real-Time Communication:** Socket.io (for notifications/chat)
 - **Authentication:** JWT
 - **APIs:** RESTful design for user/event/mentorship management
 - **Testing:** Postman
 - **CI/CD:** GitHub Actions
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Frontend Development (React)

- **State Management:** Redux Toolkit (for dashboard and real-time updates)
 - **UI Libraries:** Material-UI + styled-components (responsive design)
 - **Routing:** React Router
 - **Real-Time Features:** Axios + Socket.io client (event reminders)
 - **Design Tools:** Figma (UI/UX team), Storybook (component library)
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Mobile Development (Flutter)

- **State Management:** Provider (for user profiles and event RSVPs)
 - **Networking:** Dio (API integration)
 - **Push Notifications:** Firebase Cloud Messaging (FCM)
 - **Local Storage:** Hive (caching announcements/resources)
 - **Testing:** Flutter Testing Framework
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AI Components

- **Chatbot:** Python + TensorFlow NLP
 - **Recommendation Engine:** Collaborative filtering (scikit-learn) + Flask API (personalized event/resource suggestions)
 - **Integration:** REST APIs to connect with Node.js backend
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Security

- **Encryption:** TLS/SSL (data in transit) + bcrypt (password hashing)
 - **Access Control:** Role-Based Access Control (RBAC) for students/faculty/admins
 - **Vulnerability Scanning:** OWASP ZAP (integrated into CI/CD)
 - **Audits:** Manual code reviews + automated penetration testing
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Event & Resource Management

- **Calendar Sync:** Google Calendar API
 - **File Storage:** Firebase Storage/Amazon S3 (for academic resources)
 - **Search:** Elasticsearch (fast resource discovery)
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Infrastructure & DevOps

- **Cloud Hosting:** AWS EC2 (backend) + Vercel (frontend)
 - **Containerization:** Docker (for microservices)
 - **Monitoring:** Prometheus + Grafana (performance tracking)
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Project Management

- **Agile Tools:** Trello (sprint planning)
 - **Collaboration:** Slack/Discord (for cross-team coordination)
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