System Architecture Document

Purpose
To explain the overall structure of the system: frontend, backend, database, integrations.

Architecture Type
Client-server (SPA using React + Firebase backend)

Tech Stack
- Frontend: React (Vite), TailwindCSS
- Backend: Firebase Authentication, Firestore DB
- Storage: Firestore (NoSQL)
- Hosting: Vercel
- Others: Firebase Rules, Context API

Component Breakdown
- Auth Module: Login, Registration, Role detection
- Appointment Module: Create, View, Edit, Cancel appointments
- Messaging Module: Real-time messaging via Firestore
- User Management: Admin controls, Teacher management, Student approval

Data Flow Diagram
- User Login → Auth → Firestore (Role) → UI Redirect
- Appointment → Firestore Create → Notify Teacher
- Messages → Firestore → Real-time Listener

Optimizations
- Code: Lazy loading pages, modular services
- Architecture: Firestore security rules enforce RBAC, indexes for queries
- Deployment: Auto-deploy on commit (Vercel CI/CD)