

# High-Level Design Document: Online Judge Platform (MERN + Docker)

## 1. Overview

The Online Judge Platform is a web-based application where users can solve coding problems, run or submit code in multiple programming languages, and get automated verdicts. It supports secure and isolated code execution using Docker containers, a role-based authentication system, and AI-enhanced features such as code review and alternative suggestions.

## 2. Tech Stack

Frontend	React.js, Tailwind css
Backend	Node.js, Express.js
Database	MongoDB
Authentication	JWT(admin/user)
Code Execution	Docker for isolation
AI Integration	GPT based APIs

## 3. Database Design

- a. Users Collection:- id, name, email, password, role(user/admin).
- b. Problems Collection:- id, title, company tags, level of difficulty, topics, Description, constraints, hints, sample inputs, sample outputs.
- c. Submission Collection:-id, u\_id, p\_id, code, language used, verdict, submission time, runtime, memory used.
- d. Testcases Collection:-id, p\_id, input, output.

## 4. Backend (Restful APIs)

### a. Authentication

Method	Route	Description
POST	/api/auth/register	Register new user/admin
POST	/api/auth/login	Authenticate and return JWT
POST	/api/auth/logout	Logout and clear session

### b. User Profile

Method	Route	Description
GET	/api/user/profile/:id	View user profile info and stats

### c. Problems

Method	Route	Description
GET	/api/problems	Get list of all problems
GET	/api/problems/:id	Get details of a single problem
POST	/api/problems	Admin only: Add a new problem
PUT	/api/problems/:id	Admin only: Modify problem
DELETE	/api/problems/:id	Admin only: Delete problem

### d. Submissions

Method	Route	Description
POST	/api/submissions/run	Run code with sample inputs
POST	/api/submissions/submit	Submit code for full evaluation
GET	/api/submissions/user/:uid	Get all submissions of a user
GET	/api/submissions/:id	View a specific submission

## 5. Frontend (UI Screens)

### a. Authentication Screens

- Register: Form for name, email, password, role.
- Login: Secure login using email and password.
- Authenticated routes redirect based on role

### b. Home Page

- General overview
- Navigation to Problems, Submissions, Profile, Admin (if role=admin)

### c. Problem List Page

- Displays list of problems
- Filters by difficulty, tags

### d. Problem Page

- Full problem details: title, description, constraints, hints
- Code editor with language selector
- Buttons: Run, Submit

### e. Submissions Page

- View previous submissions with verdicts, language, timestamps

#### f. Profile Page

- User info, problems solved

#### g. Admin Panel

- Add/Edit/Delete problems
- Add/edit test cases
- Only accessible to admin role via protected routes

### *6. Docker Usage*

Docker is used to securely execute user-submitted code inside isolated containers. This ensures safety, scalability, and control over resource usage.

- Prevents code from accessing system resources
- Handles multi-language support in isolated environments
- Ensures fair and safe evaluation

### *7. AI Enhancements*

AI Code Review, Alternate Method Suggestions, Time & Space Complexity Estimation.