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|  | **Title :** **Project Registration & Progress Review** | | **FF No. 180** |  | |
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| **Department:** Computer Science and Engineering (Artificial Intelligence) | | **Academic Year:** 2025-26 | | |
| **Semester:** 01 | | **Group No:** 05 | | |
| **Project Title:** CodeX: Multi-Player Coding Challenge Platform | | | | |
| **Project Area:** AI/ML | | | | |
| **Group Members Details:** | | | | |

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| Sr. No. | Class & Div. | Roll No. | G.R.No. | Name of Student | Contact No. | Email ID |
| 01 | Btech CSAI | 54 | 12210294 | Prajyot Borikar | 8421379774 | prajyot.borikar22@vit.edu |
| 02 | Btech CSAI | 55 | 12210488 | Pranav Ratnalikar | 7758063017 | pranav.ratnalikar22@vit.edu |
| 03 | Btech CSAI | 25 | 12210667 | Ashish Jha | 9322501992 | ashishkumar.jha22@vit.edu |

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| **Name of Internal Guide:** Prof Prajkta Dandavate  **Contact No:** +91- 9921301880  **Email ID:** prajkta.dandavate@vit.edu |

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| Project approved / Not approved  **Guide Project Coordinator Head of Department** |

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**Project Synopsis**

1. **Introduction**

Real-Time 1v1 Coding Challenge Platform is the interactive platform which helps two individuals to solve coding problems in a specified time frame on a head-to-head basis. It also provides an easy going effect to competitive programming with server side problem-solving, immediate feedback and built in communication facilities, thus enabling it to create competitive yet cooperative learning environment.

In terms of software industry with the fast pace of change and development, speed, accuracy, and flexibility of problem solving are vital skills of developers. The competitive coding platforms are associated with the development of these skills and fostering logical thinking, time management and learning among peers. The requirement which the project shall be responding to is the need of an interactive, equitable and efficient media which would test the various competitive programming techniques in the real world through learning and assessment.

The platform is applied in various fields such as learning institutions to be used in carrying coding competitions, organizations to be used in screening prospective hires and determining technical skills, and coding communities to be used in training programs and coding tournaments. It is also useful to self-learners and others who like competitive programming and will benefit by pitting their skills against each other.

The main aim of the given project is to create a good and trustworthy platform where the participants can compete in real time, gain instant feedback concerning their solutions, and see their improvement in time. It is meant to facilitate the enhancement of skills, healthy competition, and a reliable method of appraisal of coding skills on different contexts.

1. **Technology Stack:**
   1. Front-End

* React.js – Dynamic, component-based UI for editor, leaderboard, and communication features.
* Tailwind CSS – Modular and responsive styling.
* Monaco Editor – Real-time code editor.
* WebSocket– Real-time synchronization and communication.
* Chart.js – Visual representation of performance analytics and leaderboards.
  1. Back-End
* Python– REST APIs
* WebSocket (Socket.IO) – Real-time bidirectional communication.
* Docker – Containerized code execution environments.
* Redis – Session caching, matchmaking queues, and leaderboard updates.
* RabbitMQ –task management for validation and plagiarism checking.
  1. Databases
* Relational Database: user profiles, ratings, leaderboards, match history.
* NoSQL Database: code submissions, test case results, analytics logs.

* 1. Machine Learning/ Deep Learning:
* Plagiarism Detection – Moss + Siamese Neural Network.
* Code Quality Assurance – LSTM-based deep code review.
* Test Case Generation – Genetic Algorithm.
  1. Other Technologies:
* Judge0 – Secure, sandboxed code execution.
* WebRTC – Real-time communication and collaboration.

1. **High-Level Design:**

The system is a modular, service-oriented architecture enabling real-time coding matches, evaluation, and analytics. Components communicate via APIs and WebSockets,.

* Major Components:
  + User Interface Layer (Front-End)
    - Matchmaking screen, real-time code editor, leaderboards and other interfaces.
  + Application Layer (Back-End Services)
    - Matchmaking Service: Uses the Elo rating system with Redis for queue management.
    - Code Execution Service: Sends submissions to Judge0.
    - Plagiarism Detection Service: Runs Moss and Siamese Neural Network analysis.
    - Test Case Generation Service: GA for automated test creation.
    - Leaderboard & Analytics Service: Aggregates data from matches for display.
    - Auth Service: Handles user authentication, authorisation, and token management.
  + Data Layer
    - Relational DB: Ratings, match history, user credentials.
    - NoSQL DB: Code submissions, test cases, logs.
  + Communication Layer
    - Socket.IO: Real-time updates and collaboration.
    - WebRTC: Voice/video peer-to-peer communication.
* HLD Diagram (Description)
  + Users connect via browser → React UI communicates with Python APIs via HTTPS and WebSockets.
  + Matchmaking service matches players and initialises the match room.
  + Code editor syncs changes via Socket.IO.
  + Submissions go to Code Execution Service → Judge0.
  + Results returned to both players and stored in databases.

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| Group No. |  | | |
| Activity | Review Schedule | Progress Review Report submitted | Signature of Guide |
| Review 1 | Mid Sem. Semester | Yes / No |  |
| Review 2 | End of Semester | Yes / No |  |

Progress Review Report:

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| **Review No.: 1 Group No.: Date:** |
| **Progress Review Report** |
| **Signature of Guide:** |

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| **Review No.: 2 Group No.: Date:** |
| **Progress Review Report** |
| **Signature of Guide:** |