 Marwadi University Marwadi Chandarana Group	Marwadi University Faculty of Technology Department of Information and Communication Technology	
Subject: Capstone Project (01CT0715)	Aim: Innovation and Originality	
Project Documentation	Date:- 25-09-2025	Enrollment No:- 92200133030 92310133007

Innovation and Originality

1. Novelty in Approach

While online coding platforms and remote code execution engines are established technologies, the innovation of the CodeArena project lies not in the invention of a new algorithm, but in the novel synthesis and purposeful application of existing technologies to create a hyper-contextualized pedagogical ecosystem. Our approach moves beyond a generic tool for practice and establishes a fully integrated platform designed to solve the specific challenges faced by students and faculty within a university setting.


1.1. The Core Innovation: A Tailored Educational Ecosystem

The primary innovation of CodeArena is its departure from the "one-size-fits-all" model of commercial platforms. Instead of being a passive repository of problems, it is an active educational environment where the content, features, and analytics are deeply interrelated with the university's curriculum and pedagogical goals.

1.2. Comparison with Existing Solutions

CodeArena's originality is best understood when compared against the two main categories of existing solutions: large-scale commercial platforms and basic open-source judging engines.


Feature / Aspect	Commercial Platforms (e.g., LeetCode, HackerRank)	Basic Open-Source Judges (e.g., DOMjudge)	CodeArena (Our Approach)
Target Audience	Global, generic audience of students and professionals.	Niche audience for competitive programming contests.	University-specific students and faculty.

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Content Curation	Curated by the platform's staff to meet broad industry trends.	Managed by contest organizers for a specific event.	Curated by university faculty to align directly with the course syllabus and campus placement needs.
Faculty Integration	None. Faculty are just another user.	Primarily administrative roles for contest setup.	Deep integration with dedicated faculty dashboards, assignment creation, and performance analytics.
Learning Path	Generally based on topic tags and generic difficulty.	No learning path; simply a list of contest problems.	Learning Path are curated based on the need of time (for placements) and can be integrated with academic requirements.
Deployment & Control	SaaS model with no control over features, data, or uptime.	Self-hosted, but requires significant technical effort to build a user-friendly platform around it.	Self-hosted and fully controlled, allowing for customization and direct integration with other university systems.

2. Contribution to the ICT Field

The CodeArena project contributes primarily to the field of **Educational Technology (EdTech)** by providing a blueprint for building context-aware, data-driven learning platforms.

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2.1. Advancing the Field

- **A Model for Hyper-Contextualized Learning:** CodeArena challenges the paradigm of massive, centralized learning platforms. It serves as a proof-of-concept that smaller, institution-specific platforms can provide a superior and more effective learning experience by leveraging local context (curriculum, faculty expertise, specific industry partners). This contributes a valuable case study to the ongoing discussion about the effectiveness of online learning tools.
- **Bridging the Theory-Practice Gap:** The project directly addresses one of the most persistent challenges in ICT education: the gap between theoretical knowledge and the practical skills demanded by the industry. By creating a tight feedback loop between coursework, practice, and industry-relevant problems, it provides a tangible solution that other academic institutions can replicate. A report by the World Economic Forum consistently cites this skills gap as a major concern, and tools like CodeArena are a direct response to this challenge.

2.2. Potential Impact on Stakeholders and Future Directions

- **For Stakeholders:** Students gain a more efficient and targeted way to prepare for their careers. Faculty are empowered with tools that reduce administrative burden (auto-grading) and provide unprecedented insight into student learning patterns. The university benefits from improved student outcomes and a stronger reputation for technical education.
- **Future Research and Development:** The data generated by CodeArena can in future be used to train ML models that help with multiple research aspects. Potential research directions include:
 - **Predictive Analytics:** Using machine learning on submission data to predict at-risk students and enable early academic intervention.
 - **Automated Plagiarism Detection:** Developing a novel algorithm trained specifically on student code submissions to identify academic dishonesty with higher accuracy.
 - **Federated Learning Model:** In the future, multiple universities could deploy their own CodeArena instances. A federated learning model could be developed to share insights and improve the AI recommendation engine across institutions without ever sharing sensitive student data, contributing to privacy-preserving AI in education.