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Development of an Online MCQ Contest Platform for Programming Assessments

G. Keerthi, N. Amarnadh, K. Akhil, P. Sathwik, P. Anupama

Student[1], student [2], student [3], student [4], student[5]
Department of Computer Science and Engineering, GMR Institute of Technology Srikakulam, 532127, India.

ABSTRACT:

This paper presents an open-source MCQ contest platform designed to meet the growing need for affordable and customizable programming assessment tools in educational institutions. Developed using the Django framework, the system supports dual-role access for administrators and students, with secure Google OAuth authentication for user management. The platform includes features such as real-time contest scheduling, dynamic leaderboards, and MongoDB-backed data storage for scalability. Its modular design enables customization of contest formats and support for multiple programming domains. The system was tested under concurrent user sessions and provided immediate feedback to participants. Results indicate improved usability and reduced infrastructure cost compared to proprietary alternatives. This work contributes to educational technology by delivering a scalable, flexible, and low-cost assessment solution. Its successful implementation suggests strong potential for adoption in academic environments.

KEYWORDS:- *Educational Technology, Programming Assessment, Django Framework, MCQ Platform, Open-Source Learning Tools*

1. Introduction

The increasing demand for online programming education and evaluation has highlighted the limitations of conventional assessment tools in academic settings. While many institutions seek to digitize and streamline their examination processes, most available platforms are either commercially expensive, inflexible, or fail to support customizable features suited for diverse institutional needs. This creates a significant gap between what educational institutions require and what existing platforms offer.

To address this gap, this paper introduces a scalable and cost-effective MCQ contest platform, specifically designed to support programming-related assessments. Built using the Django framework, the platform follows the Model-View-Template (MVT) architectural pattern and leverages MongoDB for efficient data storage. The system implements a dual-role structure, enabling both administrators and students to interact with the application through tailored dashboards. Administrators can create, edit, and manage contests, while students can participate in real-time and view instant feedback along with performance analytics.

Key features of the platform include Google OAuth-based authentication, customizable question types (single and multiple select), leaderboard generation, and real-time score tracking. These features collectively contribute to a seamless user experience and improved academic integrity during evaluations.

This research aims to bridge the affordability and flexibility gap in digital assessment tools for programming education. The platform has been tested under practical conditions to ensure stability, scalability, and usability. Through this work, we demonstrate how open-source technologies can empower educational institutions to manage assessments without incurring high costs or compromising functionality.

2. Literature Survey

The paper " Codeflex: A web-based platform for competitive programming " by Britoand M., & Goncalves presents a structured approach to designing and implementing effectivee-learning systems. Codeflex is a web platform designed for competitive programming, allowing users to solve coding problems and participate in tournaments. The platform features a simple interface, minimal images for faster loading, and is mobile-friendly, making it easy for users to navigate.The platform aims to enhance its features, including better evaluation toolsand management for tournaments.[1]

The paper "A Novel Approach for Remote Compilation using Docker Containers " by Selvakumar. The goal is to create a secure, efficient, and lightweight remote compilation system that protects server resources and supports multiple programming languages without requiring users to install compilers or libraries. web interface for users to write, compile, and run code. Docker containers that isolate the execution environment, ensuring security. A backend

that processes inputs and returns results efficiently. Testing proved that the system handles malicious code and errors without crashing, making it reliable for practical use.[2]

This paper presents E-Lab, a web-based platform designed to automatically assess programming problems. It provides instant feedback, automated grading, and centralized tracking of student progress. Supporting C, C++, and Java, the system ensures a secure and scalable environment for conducting assessments. E-Lab significantly reduces instructor workload, promotes self-paced learning, and maintains version-controlled submissions, making it an effective tool for programming education.[3]

The paper introduces a gamified, personalized training framework designed to boost student engagement and motivation in competitive programming. It tailors the training to individual skill levels, offering real-time feedback and exercises that simulate contest conditions, enhancing coding abilities. By providing immediate responses to coding attempts, the system promotes rapid learning and skill development. This approach makes the learning process more interactive and enjoyable, aligning the training with each student's progress for improved outcomes..[4]

The primary goal is to develop a platform for efficient coding skill evaluation, focusing on scalability, fairness, and consistency. It simplifies recruitment, skill assessment, and educational testing by providing instant feedback and analysis, reducing manual effort for recruiters. The portal is built using Python with Django for the backend. Machine learning tasks are supported by TensorFlow and Scikit-learn, while data processing and visualization are handled using Jupyter Notebook, Pandas, and Matplotlib. The front-end utilizes HTML, CSS, and JavaScript, with MySQL for the database. [5]

The paper by Wu, J., Chen, S., & Yang, R. (2012), titled "Development and application of online judge system," presents an online judge system (OJS) that automates the evaluation of programming submissions. This system is designed to enhance learning in competitive programming and can be integrated into university courses to improve students' coding skills and engagement. It also addresses issues with traditional teaching methods by incorporating an ACM contest mode, offering a more efficient and engaging way to assess programming abilities. The paper details the system's design, implementation, and application, and was presented at the 2012 ITHET Symposium..[6]

The paper by Patil, M. S., Deore, S. N., & Bisht, M. H. (2022), titled "Synergic coding system: an online coding platform," introduces an online judge system (OJS) designed to enhance competitive programming education. The Synergic coding system provides a platform that helps students practice and assess their coding skills in a simulated competitive environment, supporting their growth in programming contests. Published in the International Journal of Research in Applied Science and Engineering Technology, the paper discusses the development and application of this innovative platform for educational purposes. [7]

The paper presents a comprehensive automated programming assessment system. Designed to evaluate programming tasks and skills automatically, the system benefits educational institutions and competitive programming platforms by streamlining the assessment process.

The paper discusses the challenges of traditional programming assessments and how automation offers efficient, scalable solutions. It details the system's architecture, implementation, and applications, highlighting its role in enhancing computer science education by supporting both educators and learners. [8]

The paper "Software for Programming Contest" by Patil, P. (2019), published in the International Journal for Research in Applied Science and Engineering Technology, discusses the development of a system designed to automate programming contest evaluations at the institute level. The system aims to provide immediate results, streamlining the contest process and making it more efficient and objective by reducing human error and time consumption in traditional manual evaluations. [9]

The paper "On-line Contests Hosting Service as a Tool to Teach Computer Science Students Programming" , an online service designed to teach programming to computer science students. The service enables students to submit programs online, which are automatically checked, compiled, and executed, making it a valuable tool for assignments, solution validation, and improving the teaching process. The authors share their experiences using ZawodyWeb in teaching algorithms and programming to secondary school students, highlighting its effectiveness in enhancing learning outcomes and streamlining the educational process.[10]

3. METHODOLOGY

Working:
The platform operates through a structured workflow designed for both administrators and students. Users can register or log in using Google OAuth, after which they select their role. Role-based access ensures that users are directed to the appropriate dashboard.
For administrators, the dashboard enables creating, editing, and deleting contests. Contests can be customized with different question types (MCQ/MSQ), time limits, and scoring systems. Admins can also monitor contest progress and view analytics through a leaderboard.
For students, the dashboard provides access to upcoming and active contests. Students can attempt contests within the allotted time, submit their answers, and receive immediate feedback. They can also view their scores, past attempts, and contest leaderboards.
The system is developed using the Django framework and MongoDB for scalable data handling. It ensures secure access through OAuth, session management, and follows an MVT architecture for clean separation of logic, data, and UI.
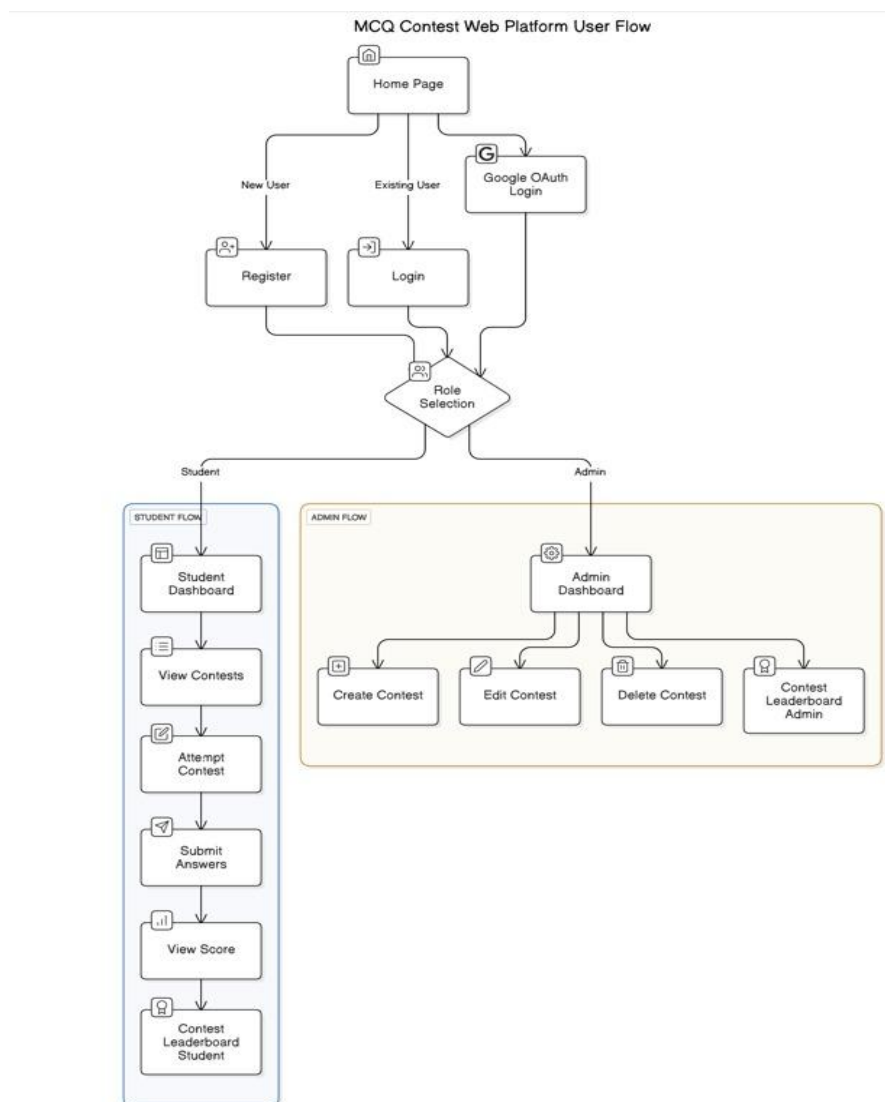
Figure 1: overall Flow of the Online Judge-MCQ Contest

1.Django Web Framework

Django, a Python-based high-level web framework, follows the Model-View-Template (MVT) architectural pattern to structure backend logic efficiently. Its purpose is to provide built-in functionalities like URL routing, session handling, and admin interfaces, enabling developers to build robust web applications quickly. The importance of Django lies in its ability to ensure rapid development, secure authentication, and an organized codebase, making maintenance and scaling easier for projects like contest platforms.

2. MongoDB Database

MongoDB is a NoSQL document-oriented database that stores data in JSON-like flexible schemas, offering a dynamic alternative to traditional relational databases. It is used to store contest data, questions, user profiles, and submission records in a structured yet adaptable format. The importance of MongoDB is its high performance, scalability, and efficient handling of non-relational data structures, which are crucial for managing the diverse and evolving data needs of a contest platform.

3. Google OAuth Authentication

Google OAuth is an open standard protocol for secure authorization that allows users to log in without revealing their credentials to the application. Its purpose is to enable user authentication through a trusted third-party provider like Google, streamlining the login process. This is important because it enhances security, builds user trust by leveraging a familiar login method, and simplifies the authentication process with Single Sign-On (SSO), making it easier for users to access the platform securely.

4. Real-Time Functionality

Real-time computing ensures that a system responds to events instantly, providing immediate updates and interactions. In this context, it is used to implement countdown timers, live score updates, and leaderboard refreshes during contests, keeping participants informed in real time. The importance

of real-time functionality lies in its ability to provide dynamic interaction, improve user engagement, and ensure timing accuracy, which are critical for maintaining fairness and excitement in competitive environments.

5. Session and Role Management

Session management tracks user states across requests, while role-based access control (RBAC) restricts access based on user roles, such as admin or student. This is used to maintain secure, role-specific navigation, ensuring that admins can manage contests while students can only participate. Its importance is in ensuring data privacy, securing contest access, and delivering a personalized experience, which helps maintain trust and functionality within the platform.

6. Frontend Technologies (HTML, CSS, JavaScript, Bootstrap)

Frontend technologies like HTML, CSS, JavaScript, and Bootstrap are essential tools for developing responsive and interactive user interfaces. They are used to render dashboards, contest pages, and results, creating an engaging and accessible experience for users. The importance of these technologies lies in their ability to enhance user experience through responsive design and intuitive navigation, ensuring that the platform is both visually appealing and easy to use across devices.

7. Timezone Handling with Pytz

Time zone handling, facilitated by the Pytz library in Python, ensures that time zone-aware computing is applied to scheduling and event synchronization globally. It is used to manage accurate contest timing across different geographical locations, preventing discrepancies in start and end times. This is important because it avoids timing issues in global or remote contest participation, ensuring fairness and accessibility for all users regardless of their location.

4.   Implementation

4.1 Frontend Development

The home page is built using Django's template inheritance system and provides a responsive layout with key components such as a navigation bar, hero section, interactive feature cards, and a footer. It enables users to access core features like contest participation, leaderboard viewing, and contest browsing. Authentication is handled through login/register buttons, with JavaScript managing redirection. The page integrates with Django's routing, session management, and authentication system, ensuring a seamless and secure user experience.
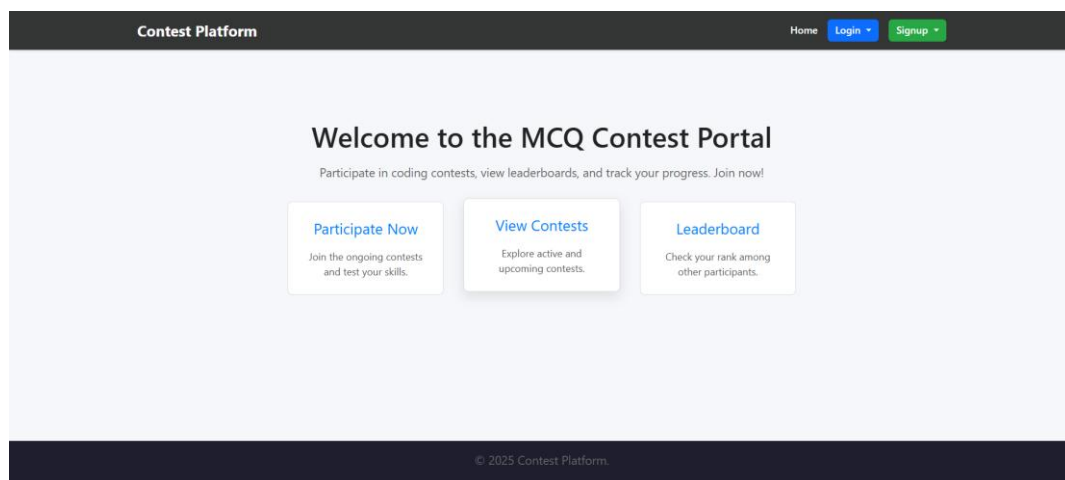
Figure 2: Home Page of Online Judge -MCQ contest

Student Dashboard:

The student dashboard provides a personalized interface where users can view upcoming contests, track their submissions, and monitor performance metrics like scores and ranks. Built using Django's template system, it integrates with the authentication and session modules to display user-specific data. Key features include contest status updates, submission history, and access to coding environments—all organized in a clean, responsive layout for smooth navigation.
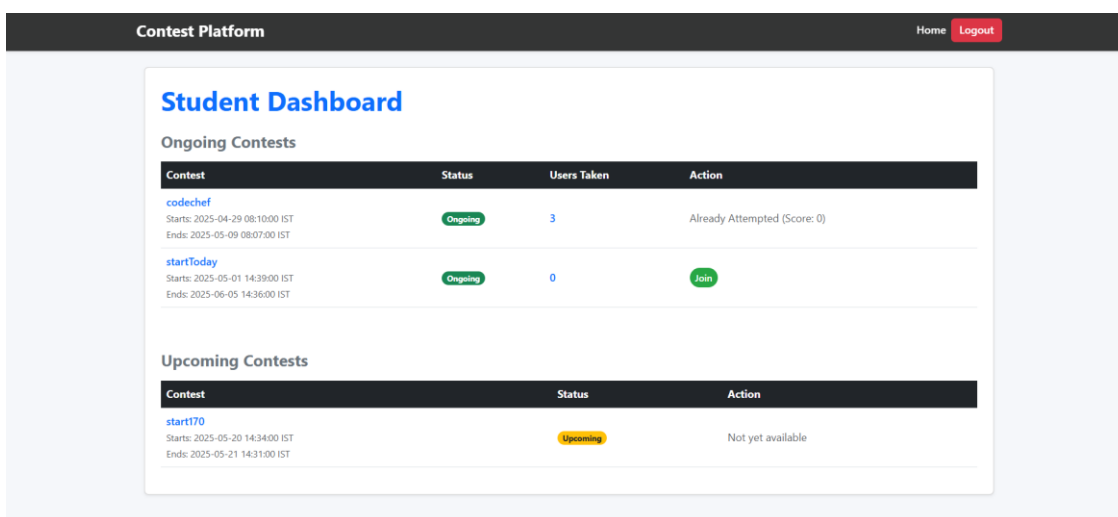
Figure 3 : Student Dashboard of Online Judge -MCQ contest

Admin Dashboard:

The admin dashboard offers a centralized interface for managing contests, displaying real-time statistics and a detailed contest table. It allows administrators to create, edit, or delete contests, track their status through color-coded badges, and access leaderboards. Built with Django templates, it features dynamic rendering, responsive design, and intuitive controls for efficient contest administration.
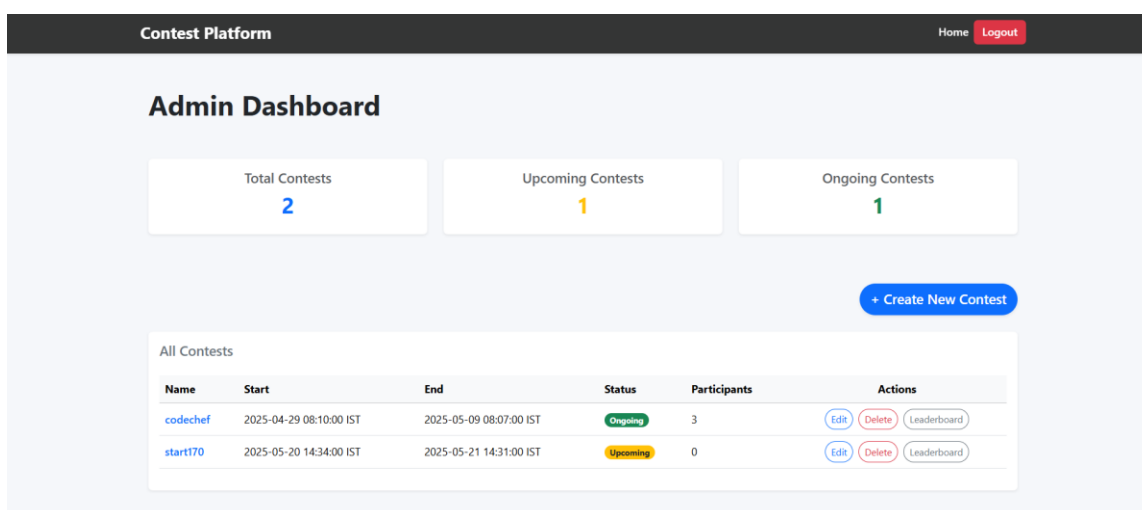

Figure 4 : Admin Dashboard for Online Judge -MCQ contest

5.   Conclusion

The MCQ Contest Platform effectively addresses the growing need for an efficient, secure, and customizable assessment system in academic environments. Developed using the Django framework and MongoDB, the platform supports real-time contest management, user authentication via Google OAuth, and a dual-role structure for both administrators and students. Its clean and intuitive interface, combined with features like dynamic leaderboards and time-bound contests, enhances the user experience while ensuring academic integrity.

The platform's modular and scalable design makes it a viable alternative to costly commercial solutions, offering flexibility to incorporate advanced features in the future—such as AI-based question generation, detailed performance analytics, and mobile compatibility. Overall, the project demonstrates a practical and innovative approach to managing programming assessments in educational settings.

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