

Blockchain-Based Academic Clearance System

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Abstract—Academic clearance is an essential process in higher education institutions, where students must obtain approval from different departments and faculty members before completing their academic requirements. Conventional clearance procedures may involve manual verification, repeated documentation, delays in approval, and difficulties in maintaining reliable records. This paper presents a Blockchain-Based Academic Clearance System, a web-based platform developed to simplify and manage the academic clearance process through a centralized digital workflow. The system provides role-based functionality for administrators, faculty members, and students. Administrators can manage student records, faculty information, subjects, and teaching assignments, while faculty members record attendance and internal assessment marks for assigned students. The system evaluates clearance eligibility using predefined academic conditions, requiring attendance of at least 85% and internal marks of 20 out of 50. Students can monitor their subject-wise clearance progress and overall completion status. Upon successful completion of the required clearances, the system generates a digital certificate and maintains its verification record using SHA-256-based blockchain hashing. The platform also supports certificate verification, Excel-based data management, and restricted student access. The proposed system integrates academic verification, clearance tracking, certificate generation, and blockchain-based record validation into a unified platform, providing a structured approach to digital academic administration.

Index Terms—Blockchain, Academic Clearance, Student Management System, Digital Certificate, SHA-256, Certificate Verification, Academic Eligibility, Role-Based Access Control, MERN Stack, Educational Administration.

I. INTRODUCTION

Academic clearance is an important administrative process in educational institutions, ensuring that students satisfy the required academic conditions

before completing a semester or receiving official certificates. The process commonly involves verification of attendance, internal assessment marks, departmental approvals, and other institutional requirements.

Traditional academic clearance procedures involve manual verification of attendance, internal assessment marks, faculty approvals, and administrative records. These activities can make the overall process difficult to monitor and limit visibility into individual students' clearance progress [1], [2]. Recent developments in digital academic management have explored automated verification, centralized record management, and secure approaches to improving institutional workflows [3], [4].

The increasing use of web-based technologies provides opportunities to improve the organization and verification of academic clearance records. Automated eligibility checking can assist in identifying whether students satisfy predefined academic requirements, while role-based access can organize approval responsibilities among faculty members and administrators [2], [5]. Cryptographic hashing and linked records can also support the verification of stored information and help identify unauthorized data modifications [7], [8], [10]. These developments indicate the potential for combining automated processing with conventional academic clearance workflows.

Another important aspect of academic clearance is the authenticity of generated certificates and the reliability of stored records. Conventional digital documents may require additional verification to establish their validity [7], [8]. Hash-based verification provides a mechanism for checking certificate information and detecting changes in recorded data [10].

To address these requirements, this paper presents the Blockchain-Based Academic Clearance System, an integrated web-based platform for managing student clearance through a unified workflow. The system

provides role-based functionality for students, faculty members, and administrators. Students can access their clearance information, while faculty members can record attendance, internal marks, and subject-wise approval details [1], [3].

The system uses automated eligibility checking to support clearance decisions, while faculty members can manage assigned student records and update clearance status. Administrators can manage academic records and monitor clearance activities within the same platform. The system also supports PDF certificate generation and verification using SHA-256 cryptographic hashing [7], [8], [10]. It aims to ensure transparent, secure, and efficient academic clearance. Unlike systems that focus only on maintaining academic records, the proposed Academic Clearance System integrates student management, automated eligibility checking, faculty approvals, certificate generation, and verification into a unified platform. The objective is to provide a structured digital workflow that connects students, faculty members, and administrators while maintaining relevant academic clearance information throughout the process. The system is developed with consideration of existing research in digital student clearance, academic record management, automated approval workflows, and secure document verification [1]–[10].

The remainder of this paper presents the related work, proposed system architecture, methodology, implementation, experimental setup and evaluation metrics, results and discussion, and conclusion.

II. LITERATURE REVIEW

Recent studies have investigated the use of web-based platforms and automated processing to improve student clearance and academic record management. Mangubat et al. [1] examined an online student clearance management system, highlighting the role of digital platforms in organizing institutional clearance activities. Eweoya et al. [2] explored a web-based approach for streamlining higher education clearance procedures. Hasan et al. [3] investigated the digital transformation of student clearance at Soran University, demonstrating the relevance of centralized systems in managing academic administrative processes.

Automated workflows have also been explored for

improving institutional operations. Batisatic et al. [4] presented E-Clearance, focusing on digitizing student clearance activities, while Adegoke and Olalekan [5] investigated workflow-driven clearance with multi-departmental integration. Mahlan et al. [6] studied a web-based system for managing student attendance and assessment submissions. These studies highlight the importance of connecting academic records, assessment information, and approval activities to reduce manual processing and improve coordination. Digital document authenticity and academic information verification are other important areas of research. Wellem et al. [7] investigated academic document authentication using digital signatures and QR codes, while Adithia et al. [8] explored document verification using cryptographic techniques, including SHA-256. Makkaraka et al. [9] examined a web-based student academic information system, emphasizing the role of digital platforms in academic record management. The Secure Hash Standard published by NIST [10] provides the cryptographic foundation for generating hash values that can be used to check whether stored information has been modified.

The reviewed studies indicate that automated eligibility checking, faculty approvals, academic record management, and certificate verification can contribute to more structured academic clearance.

However, these capabilities are addressed individually across the reviewed works. The proposed Academic Clearance System integrates these functions into a single platform, combining student management, automated eligibility checking, faculty approvals, certificate generation, and SHA-256-based verification for students, faculty members, and administrators. This forms the basis for the proposed system and its evaluation.

III. METHODOLOGY

The methodology of the Blockchain-Based Academic ClearanceSystem is designed to provide a structured workflow for managing, verifying, approving, and completing student clearance through a unified web-based platform. The system integrates role-based access, automated eligibility checking, faculty approvals, academic record management, and SHA-256-based certificate verification.

A. Student Clearance Request

The process begins when a student accesses the system through the student interface. The student provides the required academic details, including department, semester, and section. Based on the entered information, the system identifies the applicable subjects and displays the corresponding clearance status. The student can monitor the progress of subject-wise approvals through the dashboard.

B. Automated Eligibility Checking

After the faculty records the academic details, the system evaluates the student's eligibility for clearance. Attendance percentage and internal assessment marks are checked against predefined requirements of 85% attendance and 20 out of 50 marks. Based on these conditions, the system determines whether the student satisfies the eligibility criteria for subject-wise clearance.

C. Faculty Clearance

Once the eligibility information is processed, the assigned faculty member reviews the student's academic records and updates the subject clearance status. The faculty assignment is determined according to the department, semester, and section. This process ensures that subject-wise clearance is managed by the responsible faculty members and contributes to the student's overall clearance progress.

D. Faculty-Side Clearance Handling

Faculty members can access student records assigned to their subjects through the faculty interface. They can view attendance percentages, internal assessment marks, and clearance information. The system allows faculty members to review the academic details of each student and verify eligibility for clearance.

E. Administrative Monitoring

The administrator provides overall monitoring and management of the academic clearance system. Administrators can manage student and faculty records, monitor clearance requests, and make necessary corrections or management changes when required. This provides an additional level of supervision while allowing the main clearance workflow to operate systematically.

F. Clearance Lifecycle

The complete methodology follows a sequential workflow:

Student Login → Academic Record Identification → Eligibility Checking → Faculty Approval → Overall Clearance → Certificate Generation → SHA-256 Verification

This methodology combines the major functions of academic clearance into a single workflow rather than treating student records, eligibility checking, faculty approvals, and certificate verification as separate processes. The approach is based on the requirements identified from existing research on digital student clearance, automated academic workflows, centralized record management, and document authentication [1]–[10].

The sequential workflow also provides continuity across the different stages of academic clearance. Once a student accesses the system, the associated academic details, attendance, and internal marks remain connected to the same student record throughout the process. The eligibility stage checks whether the required academic conditions are satisfied, while the faculty approval stage updates the subject-wise clearance status. Subsequent clearance updates and certificate details are maintained to support verification of academic completion.

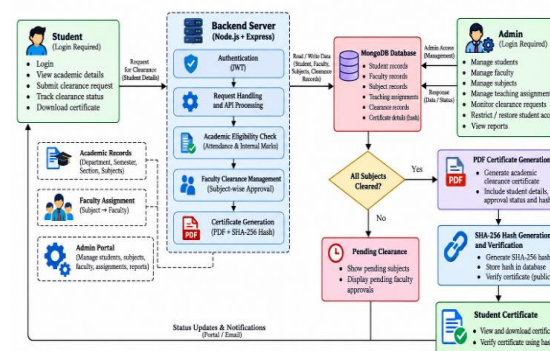


Fig. 1. Overall workflow of the Academic Clearance System.

IV. IMPLEMENTATION AND SYSTEM ENGINEERING

The Blockchain-Based Academic Clearance System is

implemented as an integrated web-based platform for managing the complete student clearance process. The system combines student registration, automated eligibility checking, faculty approvals, academic record management, certificate generation, and SHA-256-based verification. This integrated approach is motivated by previous studies on digital student clearance, automated academic workflows, centralized record management, and document authentication [1], [3], [4], [7].

A. System Architecture

The Academic Clearance System follows a role-based architecture consisting of the student interface, application processing layer, and faculty and administrator interfaces. The student interface is used for accessing academic details and tracking clearance, while the application layer processes student information and supports eligibility checking. The faculty and administrator interfaces provide facilities for academic verification, approval, monitoring, and management. The architecture combines functions explored separately in previous academic management systems [1], [3], [9].

B. Student Interface

The student interface allows users to access their academic information and monitor clearance progress by providing department, semester, and section details. Based on these details, the system identifies applicable subjects and displays their corresponding clearance status. The use of centralized academic information in student management is consistent with approaches investigated in previous digital clearance systems [1], [9]. After the faculty updates the required academic records, the clearance information is made available for further processing and status tracking.

C. Automated Eligibility Processing

The submitted academic information is processed using the system's automated eligibility module. The module checks attendance and internal assessment marks against predefined requirements to support subject-wise clearance decisions. Automated student clearance and digital academic workflows have been investigated in previous studies [2], [4], while attendance and assessment management have also been explored in academic systems [6]. In the proposed system, these concepts are incorporated into

the clearance workflow to reduce repetitive manual verification and assist faculty members in determining student eligibility.

D. Faculty Interface

The faculty interface provides access to student records assigned to the corresponding subjects. Faculty members can view attendance details, internal assessment marks, and the current clearance status of each student. The academic information enables faculty members to verify whether students satisfy the predefined eligibility requirements. Faculty members can then update the subject clearance status as students progress toward overall clearance. This supports the structured academic approval process described in previous student clearance systems [3], [7].

E. Administrator Interface

The administrator provides centralized monitoring and management of academic records. Administrators can manage student and faculty information, monitor clearance requests, and make necessary corrections when required. This administrative layer supports the management and supervision requirements associated with digital academic platforms [1].

F. Certification Generation and Verification

Certification generation is an important component of the proposed system. Once all required subject clearances are completed, the system generates a PDF academic clearance certificate. SHA-256 hashing is used to support certificate verification by checking the associated stored hash information. Students and other users can subsequently verify certificate details through the public verification facility. The use of cryptographic techniques for academic document authentication has also been explored in previous research [7], [8], [10], [9].

G. System Engineering

The system is engineered as a single integrated platform rather than as independent applications. Role-based functionality determines the operations available to students, faculty members, and administrators. The application components communicate through backend services to process academic information, maintain records, evaluate eligibility, manage approvals, generate certificates, and support verification.

The overall implementation establishes a continuous workflow:

Student Login → Academic Record Identification → Eligibility Checking → Faculty Approval → Overall Clearance → PDF Certificate Generation → SHA-256 Verification → Administrative Monitoring

This integration combines the major capabilities identified in existing research, including digital academic clearance[1], automated clearance flows [2] student clearance management [3], departmental approval processes [5], attendance and assessment management [6], academic document authentication [7], and SHA-256-based verification [8], [10].

V. RESULTS AND DISCUSSION

A. Results

The implementation of the Blockchain-Based Academic Clearance System demonstrates that the proposed platform can support the major stages of student clearance through a unified web-based system. The system allows students to access their academic information and monitor clearance progress, while faculty members record attendance and internal marks before the eligibility information is processed.

The integration of automated eligibility checking provides support for identifying students who satisfy the predefined academic requirements. This addresses the automated clearance and academic workflow approaches explored in previous studies [2], [4], [6].

The certificate verification component associates generated PDF certificates with SHA-256 hash information. Users can verify certificate details through the available verification facility, supporting the document authentication approaches discussed in previous research [7], [8], [10].

The role-based interfaces provide different functions for students, faculty members, and administrators. Students can monitor clearance status, faculty members can review academic records and update approvals, and administrators can manage and monitor academic information. This supports the structured academic management and administrative coordination considered in earlier systems [1], [3], [9].

B. Discussion

The implementation demonstrates the feasibility of combining automated eligibility checking, academic

record management, faculty approvals, certificate generation, and SHA-256-based verification within a single academic clearance platform. Instead of requiring separate mechanisms for student record management, eligibility evaluation, and certificate verification, the proposed system connects these functions through a common workflow.

A significant aspect of the system is the integration of academic information with clearance records. Attendance and internal assessment marks provide essential information for determining student eligibility, while maintaining these details within centralized platform allows faculty members to review the relevant academic records. This follows the direction of previous research involving digital student clearance and academic record management [1], [3], [6].

The automated eligibility component provides support for evaluating attendance and internal marks against predefined requirements. Previous research has investigated automated clearance workflows [2], departmental integration [5], and academic assessment management [6]. The proposed system applies these concepts as part of a broader end-to-end academic clearance workflow..

The system also provides a structured separation of responsibilities through role-based interfaces. This allows students to monitor clearance progress, faculty members to manage assigned subject approvals, and administrators to supervise academic records. Such integration is related to the broader goals of digital academic management and centralized clearance identified in previous studies [1], [3], [9].

However, the effectiveness of automated eligibility checking depends on the accuracy and completeness of the academic information entered into the system. Incorrect attendance or internal marks may affect clearance decisions. Similarly, certificate verification depends on the correctness of the stored hash information and the integrity of the verification process. Therefore, further evaluation using a larger collection of student records would be required to quantitatively measure processing time, verification performance, and other system evaluation

VI. CONCLUSION

The Blockchain-Based Academic Clearance System provides an integrated web-based approach for

managing student clearance from academic eligibility checking to certificate generation. The system combines student record management, automated eligibility checking, faculty approvals, academic status tracking, SHA-256-based certificate verification, and administrative monitoring within a unified platform.

The integration of academic records allows students to view their clearance status, while faculty members can review attendance and internal marks for assigned subjects. The automated eligibility module checks predefined academic requirements, reducing dependence on completely manual verification. Role-based interfaces further organize the responsibilities of students, faculty members, and administrators throughout the clearance lifecycle. The system also maintains subject-wise approval records to support the completion of overall student clearance.

The proposed system demonstrates the feasibility of combining the capabilities explored in previous research on digital student clearance, automated eligibility checking, academic record management, and document verification. The proposed system demonstrates the feasibility of combining the capabilities explored in previous research on digital student clearance, automated eligibility checking, academic record management, and certificate verification [1]–[10]. However, further evaluation using larger real-world student datasets is required to quantitatively assess eligibility processing accuracy, clearance completion time, verification performance, and overall system effectiveness.

Future development can focus on improving automated eligibility processing, expanding academic record management capabilities, enhancing certificate verification, and conducting larger-scale performance evaluations. Overall, the proposed system establishes a structured technological framework for improving the organization and management.

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