



International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

ANONYMOUS ASSIGNMENT EVALUATION SYSTEM

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DOI : <https://doi.org/10.55248/gengpi.06.1226.2840>

ABSTRACT :

Evaluation of assignments is a crucial part of the academic routine that allows to evaluate students' work and progress. However, conventional methods of assignment evaluation are not only time-consuming, but are also prone to certain forms of bias since evaluators can recognize identity of students. In order to overcome these problems, this paper introduces the Anonymous Assignment Evaluation System (AAES), a digital platform that provides means for the secure and anonymous evaluation of academic assignments. The platform offers a full assignment evaluation workflow that includes assignment creation, anonymous submission by the students, identification of anonymous assignments, evaluation of assignments according to the rubric, management and publishing of results of assignment evaluation. Students' identity is dissociated from their assignments through use of cryptographic anonymous tokens and encryption of identity-related information. The system is implemented as a multi-tenant web platform that utilizes such tools as MongoDB for data management, Redis for background processes and MinIO for file storage.

Keywords: Anonymous Evaluation, Assignment Assessment, Student Privacy, Cryptographic Security, Digital Education, Rubric-Based Evaluation, Academic Assessment, Web Application, Fair Evaluation, Multi-Tenant System.

1. INTRODUCTION

Assignment evaluation is an important part of the academic process, but traditional evaluation methods can be time-consuming and may introduce bias when evaluators know the identity of students. Anonymous evaluation helps reduce such bias by allowing evaluators to focus on the quality and content of the submitted work.

The Anonymous Assignment Evaluation System (AAES) is a web-based platform developed to provide secure, fair, and efficient assignment evaluation. It supports assignment creation, student submission, anonymous identification, rubric-based evaluation, and result publication. The system uses anonymous tokens and encrypted identity information to separate student identity from evaluation records.

AAES brings the assignment submission and evaluation process into a single digital platform, with features such as notifications, audit tracking, and analytics. It provides separate workflows for students, faculty, and administrators, making the evaluation process more organized and manageable. The use of predefined rubrics also supports consistent assessment across different submissions. By reducing direct access to student identity during evaluation, the system promotes a more objective assessment process.

The proposed system aims to improve the fairness, privacy, security, efficiency, and transparency of academic assignment assessment while reducing the effort involved in managing assignments and evaluation records.

2. LITERATURE SURVEY

2.1 Anurag Saha et al. (2024) – Automated 2.1 John M. Malouff et al. (2013) – The Risk of a Halo Bias as a Reason to Keep Students Anonymous During Grading

The study investigates the effect of previous knowledge about a student on grading. The researchers found evidence of a halo effect, where previous impressions of a student's performance influenced the evaluation of later work. The study suggests that keeping student identities anonymous during grading can help reduce unfair evaluation caused by prior perceptions. It highlights the importance of separating student identity from academic work during assessment. The findings support the use of anonymous grading as a method for promoting more objective evaluation. However, the study mainly focuses on the grading process rather than implementing a complete digital evaluation system.

2.2 Carina Saxlund Bischoff et al. (2021) – A Quasi-Experimental Study of Ethnic and Gender Bias in University Grading

This study compares open grading, where student names were visible, with blind grading, where only student identification numbers were shown. The research examined whether student names could contribute to gender or ethnic differences in grading. The findings provide useful evidence for understanding the role of blind grading in reducing identity-related concerns in academic assessment. The study demonstrates how concealing identifying information can support a more neutral assessment process. It also emphasizes the importance of designing assessment procedures that minimize possible sources of bias. However, it does not develop a complete software-based anonymous assignment evaluation platform.

2.3 Ernesto Panadero and Maryam Alqassab (2019) – An Empirical Review of Anonymity Effects in Peer Assessment, Peer Feedback, Peer Review, Peer Evaluation and Peer Grading

This study reviews existing research on anonymity in peer assessment and grading. It examines how anonymity can affect student performance, feedback, grading accuracy, and perceptions of assessment. The review indicates that anonymous assessment can provide advantages such as more critical feedback, although its effectiveness can depend on the educational context and assessment method. The study provides a broad understanding of how anonymity influences different forms of academic assessment. It also identifies variations in the effects of anonymity across different assessment environments. However, the work is primarily a literature review and does not provide an integrated system for anonymous assignment evaluation.

2.4 Juan Fraile et al. (2024) – Investigating Anonymity in Formative and Summative Peer Assessment: Effects on University Students' Social-Affective Factors, Perceptions and Preference

The study compares anonymous and non-anonymous peer assessment among university students. Results showed that 73.6% of students preferred anonymous peer assessment, although anonymity did not significantly change perceptions of fairness or peer pressure. The study highlights both the benefits and limitations of anonymity in academic assessment. It also examines students' perceptions and preferences regarding anonymous assessment practices. These findings indicate that anonymity can be useful from a student perspective, particularly when concerns about identification are present. However, the study focuses mainly on assessment behavior and perceptions rather than secure digital identity management.

2.5 Ernesto Panadero, Margarida Romero and J. W. Strijbos (2013) – The Impact of a Rubric and Friendship on Peer Assessment: Effects on Construct Validity, Performance, and Perceptions of Fairness and Comfort

This study examines the role of assessment rubrics in peer evaluation. The results showed that students using a rubric produced more valid assessments compared with those without a rubric. The study demonstrates the importance of structured evaluation criteria for improving consistency and reliability in academic assessment. Rubrics provide clear standards that help evaluators assess different aspects of student work systematically. They can also improve transparency by making the basis of evaluation clearer to students and evaluators. However, the study does not combine rubric-based evaluation with anonymous identity management and a complete digital assignment workflow.

Table 1. Gap Analysis of Existing Studies

Author & Year	Focus	Methods Used	Limitations / Research Gap
Malouff et al. (2013)	Anonymous grading and halo bias	Experimental grading study	Focuses mainly on grading bias and anonymity; does not provide a digital platform for anonymous assignment evaluation.
Bischoff et al. (2021)	Blind grading and identity-related bias	Quasi-experimental study	Examines the effect of visible and hidden student identities but does not provide secure identity management or online submission.
Panadero & Alqassab (2019)	Anonymity in peer assessment and grading	Empirical literature review	Reviews the effects of anonymity but does not implement an integrated anonymous evaluation system.
Fraile et al. (2024)	Anonymous and non-anonymous peer assessment	Quasi-experimental study	Mainly focuses on students' perceptions and preferences; secure digital identity separation is not addressed.
Panadero et al. (2013)	Rubric-based peer assessment	Experimental peer assessment	Highlights the benefits of rubrics but does not combine rubric evaluation with anonymous identity management.

3. METHODOLOGY

3.1 Assignment Creation and Submission

The proposed Anonymous Assignment Evaluation System (AAES) provides a digital platform for managing assignments and student submissions. Faculty members can create assignments by specifying details such as title, description, deadlines, maximum marks, and evaluation requirements. Students can view published assignments and submit their work through the system.

The assignment and submission process includes:

- Creating and configuring assignments

- Defining submission deadlines and marks
- Publishing assignments for students
- Validating student submissions
- Supporting file and text submissions
- Checking submission deadlines and attempts
- Securely storing submitted files
- Maintaining submission records

Key assignment and submission attributes include:

- Assignment ID
- Title
- Description
- Faculty ID
- Student ID
- Submission ID
- Submission File
- Submission Status
- Submission Date
- Deadline
- Maximum Marks
- Attempt Information

The submitted files are stored using **MinIO**, while assignment and submission information is maintained in **MongoDB** for further processing and evaluation.

3.2 Anonymous Identity Management

After a student submits an assignment, the system initiates the anonymous evaluation workflow. A unique anonymous token is generated using a cryptographically secure random process. The student's identity is separated from the evaluation record and stored in an encrypted identity vault.

The anonymization process includes:

- Generating a unique anonymous evaluation token
- Separating student identity from evaluation information
- Encrypting student identity using AES-256-GCM
- Storing the encrypted identity mapping
- Creating an anonymous token record
- Maintaining the relationship between submission and identity securely
- Allowing authorized users to resolve identity when required

The anonymous token follows a format such as AAES-XXXXXXXXXX and is generated using a cryptographically secure random number process. The identity vault uses AES-256-GCM encryption to protect the student identity.

Key anonymous evaluation attributes include:

- Anonymous Token
- Submission ID
- Encrypted Student ID
- Identity Vault
- Assignment ID
- Anonymization Status

This process allows the evaluation workflow to use an anonymous reference instead of directly exposing the student's identity.

3.3 Rubric-Based Evaluation and Result Processing

After anonymous identity processing, the submitted assignment is evaluated by faculty using predefined evaluation criteria. The system supports rubric management and allows evaluators to record marks and evaluation information for each submission. The evaluation module also performs marks validation and automatic calculation.

The evaluation process includes:

- Selecting anonymous submissions for evaluation
- Applying predefined evaluation rubrics
- Entering marks for different criteria
- Validating assigned marks
- Calculating the final score
- Saving and submitting evaluations
- Finalizing evaluation records
- Creating student results

- Publishing results to students

Key evaluation attributes include:

- Evaluation ID
- Anonymous Token
- Rubric ID
- Evaluation Criteria
- Marks
- Maximum Marks
- Feedback
- Evaluation Status
- Evaluator ID
- Result Status

The system stores evaluation records separately from student identity information, supporting a more structured and privacy-focused evaluation process.

3.4 Result Publication and System Management

After the evaluation process is completed, the system generates result records and provides authorized users with options to publish or manage results. Students can access their results after publication. The platform also provides supporting features such as notifications, analytics, authentication, and monitoring.

The result management process includes:

- Creating evaluation results
- Validating final marks
- Publishing results to students
- Managing result visibility
- Providing student notifications
- Maintaining evaluation history
- Generating result reports
- Supporting academic analytics
- Monitoring system health

The system provides separate workflows for administrators, faculty, and students, allowing each user to access the functions relevant to their role. Authentication and role-based access mechanisms are used to control access to system resources.

Overall, the methodology integrates React, TypeScript, NestJS, MongoDB, Redis, MinIO, anonymous token generation, AES-256-GCM encrypted identity management, rubric-based evaluation, result processing, notifications, and analytics into a unified assignment evaluation platform. The workflow enables assignments to move from creation and submission through anonymous identity management and evaluation to final result publication.

4. ARCHITECTURE AND DESIGN

The Anonymous Assignment Evaluation System (AAES) follows a modular web-based architecture designed to manage assignments securely from creation and submission to anonymous evaluation and result publication. The system integrates a React-based frontend, NestJS backend, MongoDB database, Redis-based processing, MinIO file storage, anonymous token generation, encrypted identity management, rubric-based evaluation, and result management.

4.1 Frontend (React Dashboard)

- Interactive user interface developed using React, TypeScript, and Tailwind CSS.
- Provides separate workflows for Students, Faculty, and Administrators.
- Allows faculty to create assignments, define rubrics, and manage deadlines.
- Allows students to view published assignments and submit assignments.
- Displays submission status, evaluation results, notifications, and relevant academic information.
- Provides management interfaces for assignments, evaluations, users, and results.

4.2 Backend (NestJS REST API)

- NestJS with TypeScript is used as the main backend framework.
- REST APIs handle authentication, user management, assignment creation, submissions, evaluations, and results.
- The backend manages anonymous token generation and encrypted identity mapping.
- Redis is used for background processing and asynchronous tasks.
- MongoDB with Mongoose is used for persistent storage of application data.

- MinIO is used for storing submitted assignment files.

4.3 Anonymous Evaluation and Security

- A unique anonymous token is generated for eligible assignment submissions.
- Student identity is separated from evaluation information during the anonymous workflow.
- AES-256-GCM encryption is used to protect the student identity stored in the identity vault.
- Cryptographically secure random token generation is used for anonymous identification.
- Role-based access controls restrict access to student, faculty, and administrative functions.
- The anonymous token is used as a reference during the evaluation process instead of directly displaying student identity.

4.4 Data Flow and Assignment Management

- Faculty creates and publishes an assignment through the React interface.
- Students access the published assignment and submit their work.
- Submission details are sent to the NestJS backend and stored in MongoDB.
- Submitted files are stored securely using MinIO.
- The submission initiates the anonymous evaluation workflow.
- The system generates an anonymous token and stores the encrypted student identity separately.
- Faculty evaluates the submission using predefined rubrics.
- Marks and feedback are stored in the evaluation records.
- The final result is created and published to the respective student.

4.5 Evaluation, Result Management and Monitoring

- Faculty can create and manage **rubrics** for structured evaluation.
- Evaluators can enter marks and feedback based on predefined criteria.
- The system validates marks and supports automatic score calculation.
- Evaluation records and result history are maintained for tracking.
- Students can view results after they are published.
- Notifications provide important updates related to assignments and results.
- Analytics and monitoring features provide information about system activities and academic evaluation.

Overall, the integrated architecture of AAES supports secure assignment submission, anonymous identity management, structured evaluation, result processing, and academic monitoring in a single digital platform. This architecture aims to improve the fairness, privacy, security, efficiency, and transparency of assignment evaluation.

5. RESULTS AND DISCUSSION

The proposed Anonymous Assignment Evaluation System (AAES) was implemented as a web-based academic evaluation platform using React, NestJS, MongoDB, Redis, and MinIO. The system supports the complete assignment workflow, including assignment creation, student submission, anonymous identity management, rubric-based evaluation, and result publication. The system also provides role-based dashboards, notifications, evaluation history, and academic analytics.

5.1 Results

The developed Anonymous Assignment Evaluation System (AAES) provides a web-based platform for managing users, assignments, submissions, and academic evaluation. The system provides role-based access for administrators and students and supports assignment creation and management.

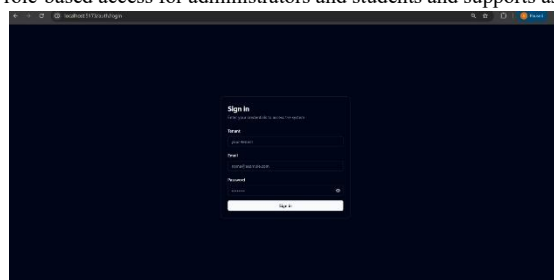


Figure 5.1.1: AAES Login Screen

The Login screen provides authenticated access to the AAES platform. Users enter their tenant, email, and password to access the system according to their assigned role.

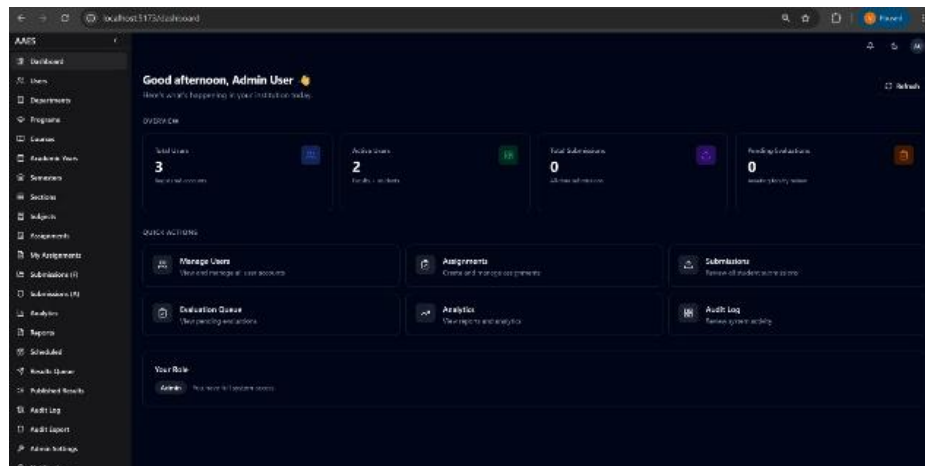


Figure 5.1.2: Administrator Dashboard

The Administrator Dashboard provides an overview of the institution's activities. It displays total users, active users, total submissions, and pending evaluations. It also provides quick access to user management, assignments, submissions, evaluation queue, analytics, and audit functions.

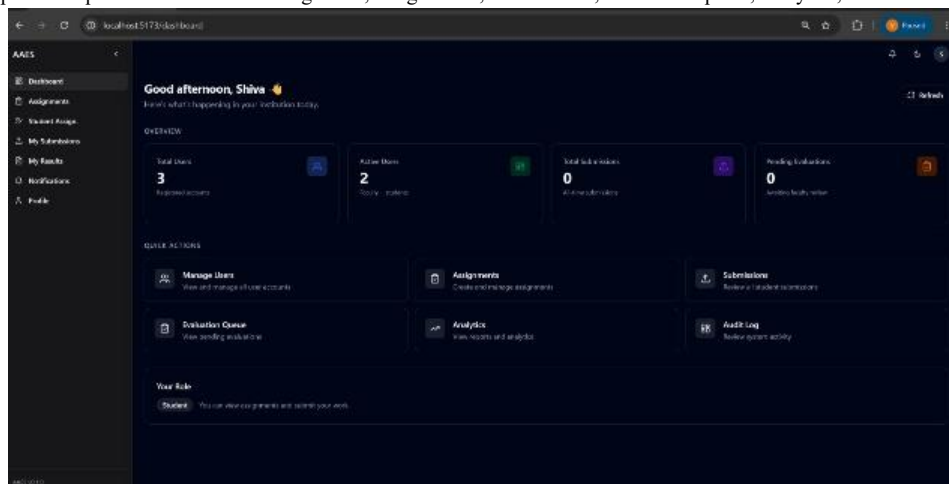


Figure 5.1.3: Student Dashboard

The Student Dashboard provides students with access to their academic activities. Students can view available assignments, manage their submissions, check results, receive notifications, and access their profile.

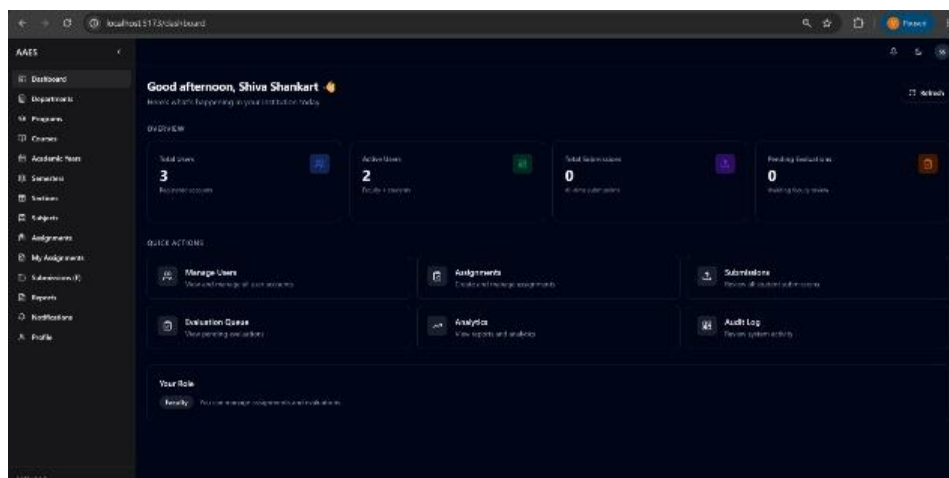


Figure 5.1.4: Create Assignment Screen

The Create Assignment screen allows faculty or authorized users to create and configure assignments. It includes fields for assignment title, visibility, submission type, department, academic year, maximum marks, passing marks, start date, due date, description, and instructions. The screen also provides options for late submission, resubmission, and anonymous evaluation.

6. CONCLUSION

This study presented the Anonymous Assignment Evaluation System (AAES), a web-based platform designed to improve the fairness, privacy, and efficiency of academic assignment evaluation. The system integrates assignment creation, student submission, anonymous identity management, encrypted identity storage, rubric-based evaluation, and result publication. The use of anonymous tokens and encrypted identity information helps separate student identity from the evaluation process and reduces the possibility of identity-based bias. The integration of structured rubrics also supports consistent and organized assessment. Overall, AAES provides an integrated solution for secure, anonymous, and efficient digital assignment evaluation.

7. FUTURE SCOPE

The proposed AAES can be further improved by implementing advanced document sanitization techniques to remove identifying information from submitted assignment files. Future versions can incorporate stronger privacy-preserving methods and improved access controls to provide more secure anonymous evaluation. The system can also be extended with AI-assisted evaluation to support faculty in analyzing submissions while keeping human evaluation as the final decision. Further improvements may include plagiarism detection, multilingual assignment support, mobile application support, advanced evaluation analytics, automated notifications, ERP/LMS integration, and enhanced reporting features.

8. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Department of MCA, Aurora Deemed to be University, Hyderabad, for providing the necessary support and resources to carry out this research work. The authors also thank the faculty members and project guide for their valuable guidance, encouragement, and continuous support throughout the development and implementation of the Anonymous Assignment Evaluation System (AAES).

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