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Design and Implementation of Transcript Management Information System: A case Study of National Institute of Construction Technology and Management, Uromi.

Akpan, Promise Monday
Obaweki, Faith Eranonsen
and
Ekpo Ekanem
[1,2&3]Department of Computer Science, National Institute of Construction Technology and Management(NICTM),Uromi, Edo State.

Abstract: *The management of academic transcripts plays a crucial role in ensuring efficiency, accuracy, and security in higher education institutions. Traditional transcript management methods, which rely on paper-based systems and fragmented digital databases, often result in inefficiencies such as delayed transcript issuance, data entry errors, and challenges in credential verification. To address these issues, this paper explores modern technological tools to develop a secure and scalable Transcript Management System. The paper reviewed existing transcript management models, emphasizing the benefits of automation, integration with Learning Management Systems (LMS) and Student Information Systems (SIS), and the role of data security measures such as encryption and Role-Based Access Control (RBAC). A systematic methodology was employed to analyze current challenges, design an improved system architecture, and implement a functional system using waterfall model. The designed system enhances institutional efficiency by streamlining transcript processing, reducing administrative workload, improving data accuracy, and ensuring compliance with regulatory standards. It also provides students with real-time access to their academic records while maintaining robust security protocols to prevent unauthorized data access. The paper contributes to the field of educational technology by demonstrating the effectiveness of a digitally optimized TMS in addressing real-world challenges in academic record management. Conclusively, the challenges associated with Transcript Management System (TMS) and the ways of surmounting the challenges with modern technological advancements where highlighted. It was recommended among others that developing a mobile-friendly application would increase accessibility for students, enabling them to request and download transcripts conveniently from their smartphones.*

Keywords: Transcript, Transcript Management System, Waterfall software development methodology.

Introduction

The management of academic records, particularly transcripts, is a critical function in higher education institutions, directly impacting administrative efficiency, student satisfaction, and institutional credibility. Traditionally, transcript management in many academic institutions, including the National Institute of Construction Technology and Management (NICTM), Uromi, has relied on manual or semi-automated processes. These systems often involve paper-based record-keeping, fragmented digital databases, or outdated software solutions, leading to inefficiencies such as delayed transcript issuance, data entry errors, and challenges in verifying academic credentials (Li et al., 2019).

The primary aim of this study is to design and implement a transcript management system tailored to the needs of the National Institute of Construction Technology and Management, Uromi and to proffer solutions to such existing problems, with a more effective electronic system that provides a detailed future plan that gives room for more improvement in the system, such that it handles students records, enabling easy accessibility and information flow within the institution. Specifically, the study seeks to achieve the following objectives:

- To Develop and implement a transcript management system capable of scaling with the growth of the student population and expanding academic programs without compromising performance or reliability.
- To Facilitate Efficient Data Collection and Analysis: Automate the collection, organization, and analysis of transcript data to enable timely insights and support evidence-based decision-making.

Literature Review

A modern Transcript Management System (TMS) is designed to automate the processes of storing, retrieving, and managing academic records, ensuring data accuracy, security, and ease of access. Unlike traditional paper-based systems, which are prone to errors, delays, and data loss, digital transcript systems leverage advanced technologies to improve efficiency and reliability. According to Kasani and Mourkani (2020), the core features of a TMS include student record management, automated GPA calculations, secure transcript generation, and role-based access control.

The student record management feature is the backbone of any TMS, encompassing the collection, storage, and organization of data such as student personal details, course enrollments, grades, attendance records, and disciplinary history. This data is typically organized in relational databases to support efficient querying and reporting. Li et al. (2019) emphasize the importance of data normalization in transcript systems, which reduces redundancy and improves data integrity.

Another critical feature is automated GPA calculation, which eliminates manual errors and ensures consistency in academic performance evaluations. Wu et al. (2019) highlight that automation not

only reduces administrative workload but also allows real-time monitoring of student progress, facilitating timely interventions for at-risk students.

The transcript generation and printing functionality are also key components. A well-designed TMS allows authorized users to generate official transcripts on-demand, complete with institution logos, digital signatures, and security features such as QR codes for easy verification. According to Zhang et al. (2020), integrating digital signature technology enhances the authenticity of transcripts, reducing the risk of document forgery.

Role-based access control (RBAC) is another vital feature, ensuring that only authorized personnel can access sensitive academic records. Fatimah et al. (2020) argue that implementing RBAC not only protects student privacy but also complies with data protection regulations like the General Data Protection Regulation (GDPR). For instance, students may have permission to view their records but cannot modify them, while administrative staff have broader access rights to manage data.

METHODOLOGY

The Waterfall Model has been adopted for the Transcript Management System (TMS) for the National Institute of Construction Technology and Management (NICTM), Uromi. The Waterfall Model is a linear-sequential software development methodology where each phase must be completed before the next phase begins. Given the structured nature of transcript management, where accuracy, security, and reliability are critical, the Waterfall Model provides a disciplined approach that ensures systematic development and thorough documentation.

Phases of the Waterfall Model in this Study

The following stages of the Waterfall Model will be implemented for the development of the Transcript Management System:

1. **Requirement Analysis:**This phase involves gathering and documenting requirements from stakeholders, including students, administrative staff, and IT personnel at NICTM, Uromi. The primary objective is to understand the limitations of the current system and define the necessary improvements.

2. **System Design:**The system's architecture, database design, and overall structure will be established in this phase. Detailed system diagrams, including use case diagrams, entity-relationship diagrams, data flow diagrams, and sequence diagrams, will be created. The design will focus on a three-tier architecture consisting of a user interface, application logic, and database layer to ensure security and scalability.

3. **Implementation:** The actual coding of the system will take place in this phase. The system will be developed using web technologies (HTML, CSS, JavaScript, and python django) for the front-end, while MySQL will be used for the database.The development will follow a modular approach, ensuring that different components of the system can be tested and maintained independently.

4. **Testing:** The system will be subjected to rigorous testing, including unit testing, integration testing, system testing, and user acceptance testing (UAT). This phase ensures that the system functions as expected, meets security standards, and is free of major bugs before deployment.

5. **Deployment:** Once testing is complete, the system will be deployed in a live environment at NICTM, Uromi. The deployment process will include data migration from paper-based records to the digital system and training for administrative staff on system usage.

6. **Maintenance:** Post-deployment, continuous monitoring and maintenance will be carried out to resolve any unforeseen issues.

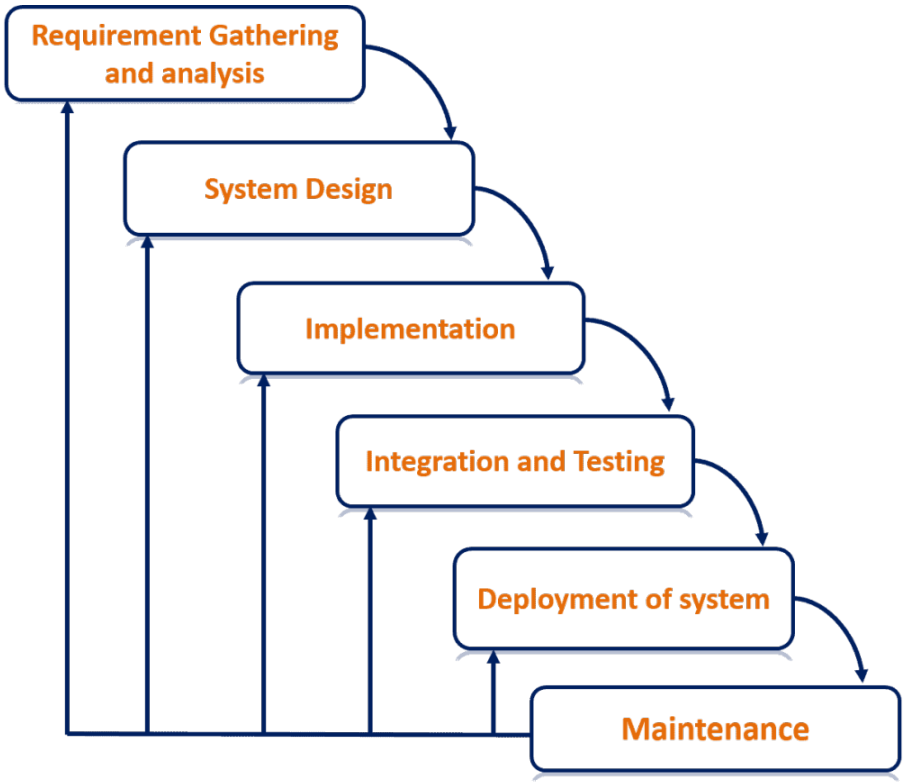

Fig*1: Waterfall Methodology*

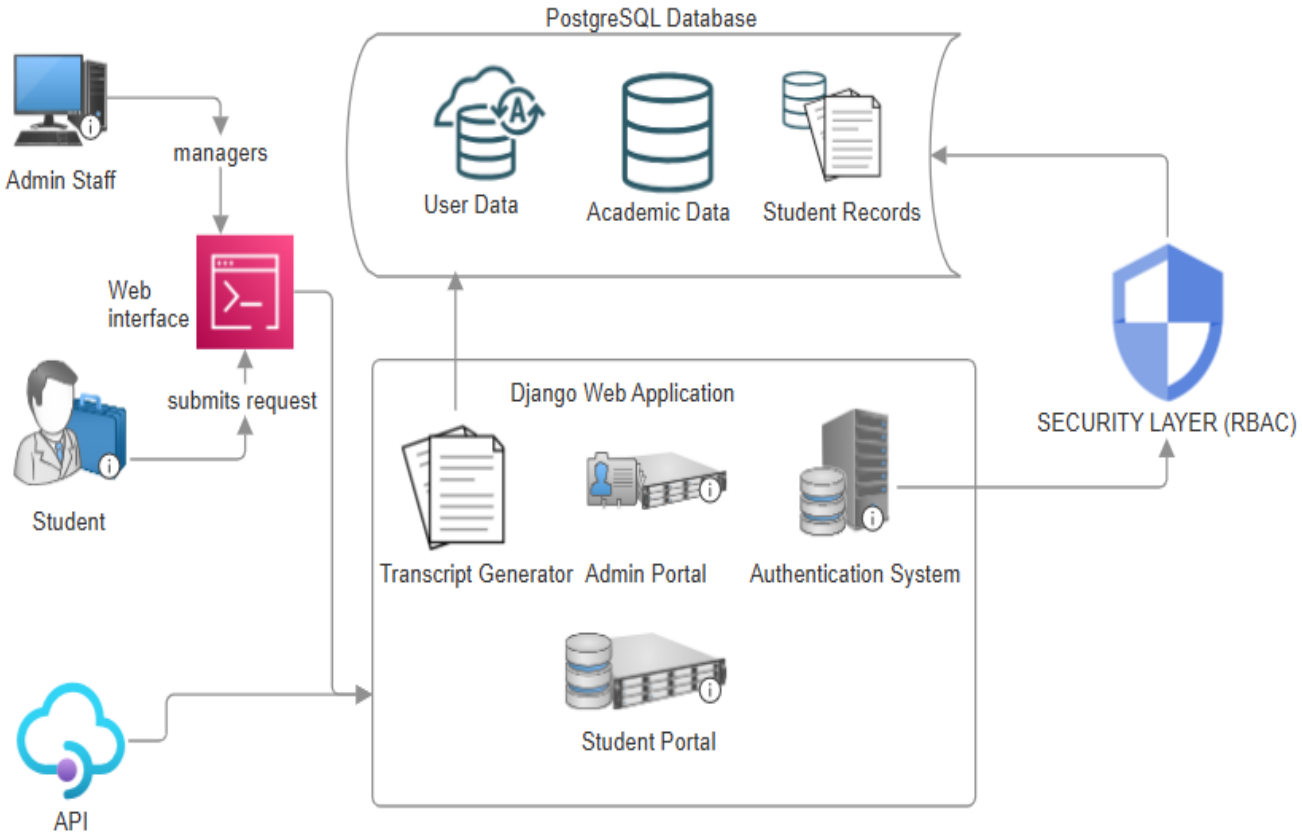

Fig2:*Architectural design of the system*

The Use Case Diagram illustrates the interaction between system users (students and administrators) and the Transcript Management System (TMS). Students can request a transcript, check their request status, and download the generated transcript. Administrators have more privileges: they can approve requests, manage student records, and generate transcripts. When a student requests a transcript, the system processes it and forwards it to an administrator for approval. Once approved, the system generates the transcript and makes it available for download. This diagram ensures that all key functionalities are defined and mapped to the correct user roles.

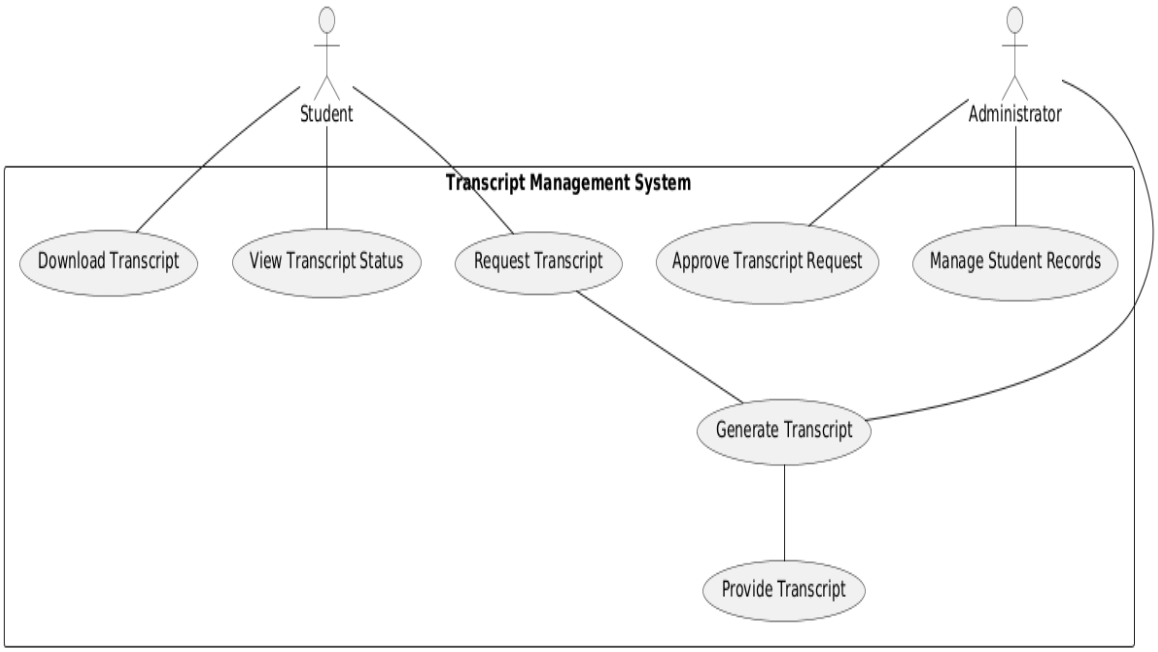

Fig: 3 Use Case Diagram of the system

The Sequence Diagram shows the step-by-step process when a student requests a transcript. The student sends a request to the Transcript Management System (TMS), which retrieves the required academic records from the database. The request is then sent to an administrator for approval. Once the administrator approves the request, the system generates the transcript, saves it in the database, and provides a download link to the student. This diagram ensures a clear flow of interactions between users and the system while maintaining proper authorization and validation at each step.

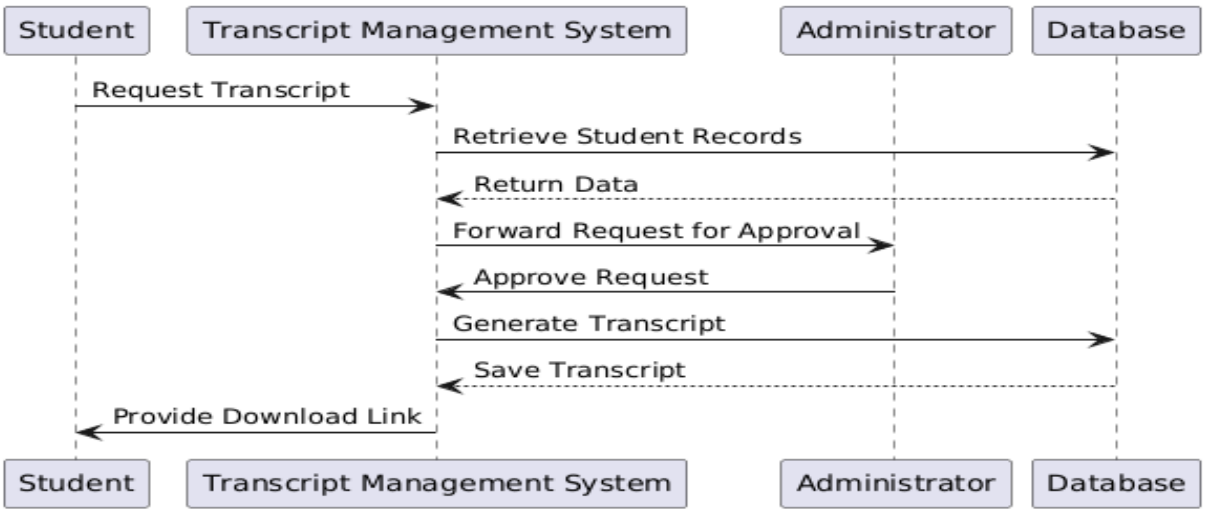

Fig: 4 Sequence Diagram of the System

The Activity Diagram outlines the workflow of the transcript request process. A student logs into the system and requests a transcript. The system validates the request, retrieves student records, and checks whether administrative approval is needed. If approval is required, the request is sent to an administrator, who approves it before transcript generation. Once approved, the system generates the transcript, saves it in the database, and provides a download link to the student. This diagram ensures a structured process flow, reducing errors and delays in transcript generation.

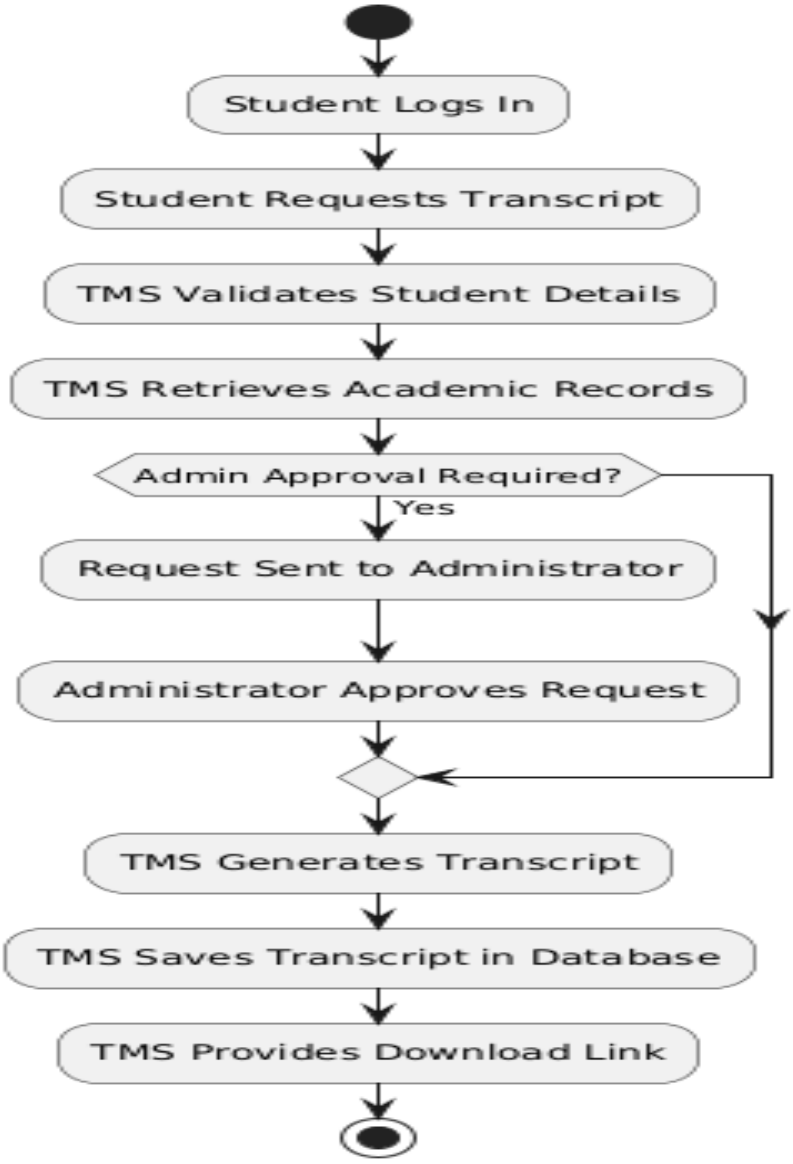

Figure 5:Activity Diagram of the System

RESULT

This section presents the results of the research and this is done by showing outputs of the Transcript Management System (TMS) for the National Institute of Construction Technology and Management, Uromi with some explanations.

Figure 6 is the Login Page. The login screen serves as the gateway to the system, where users authenticate themselves before gaining access to specific functionalities.

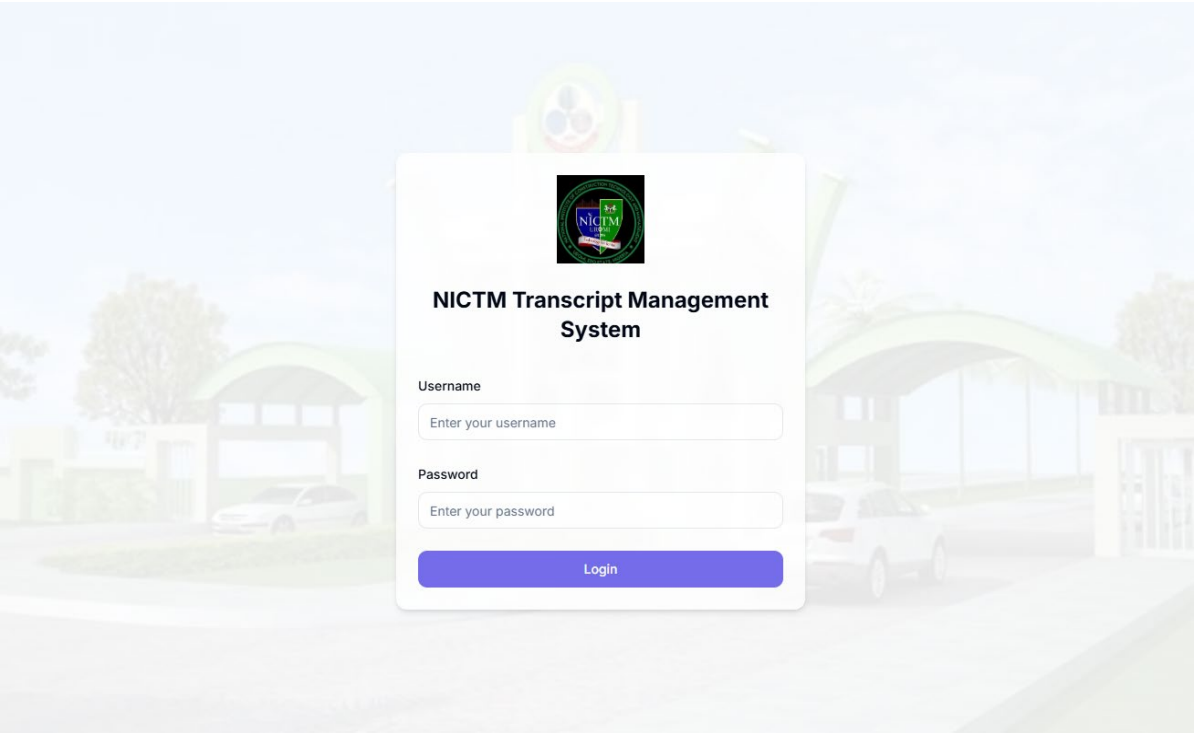

Figure 6: login process

Figure 7 Student Dashboard**.**Once a student logs in, they are directed to theStudent Dashboard, which acts as a personalized interface displaying essential academic details. Here, students can view their biodata, enrolled courses, and current GPA.

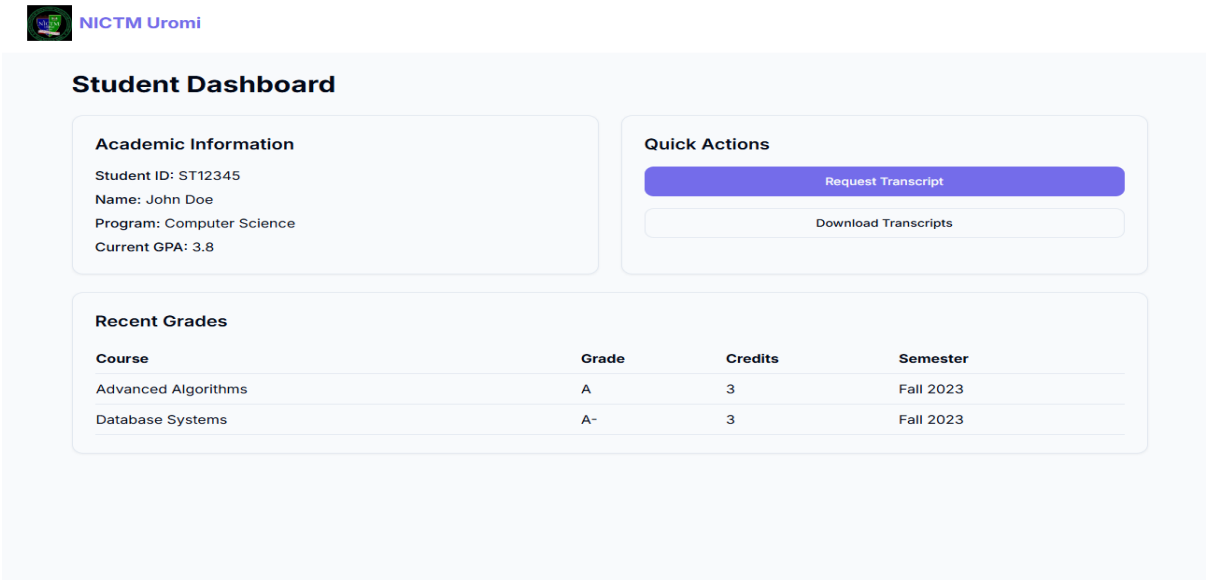

Figure 7: Student Dashboard

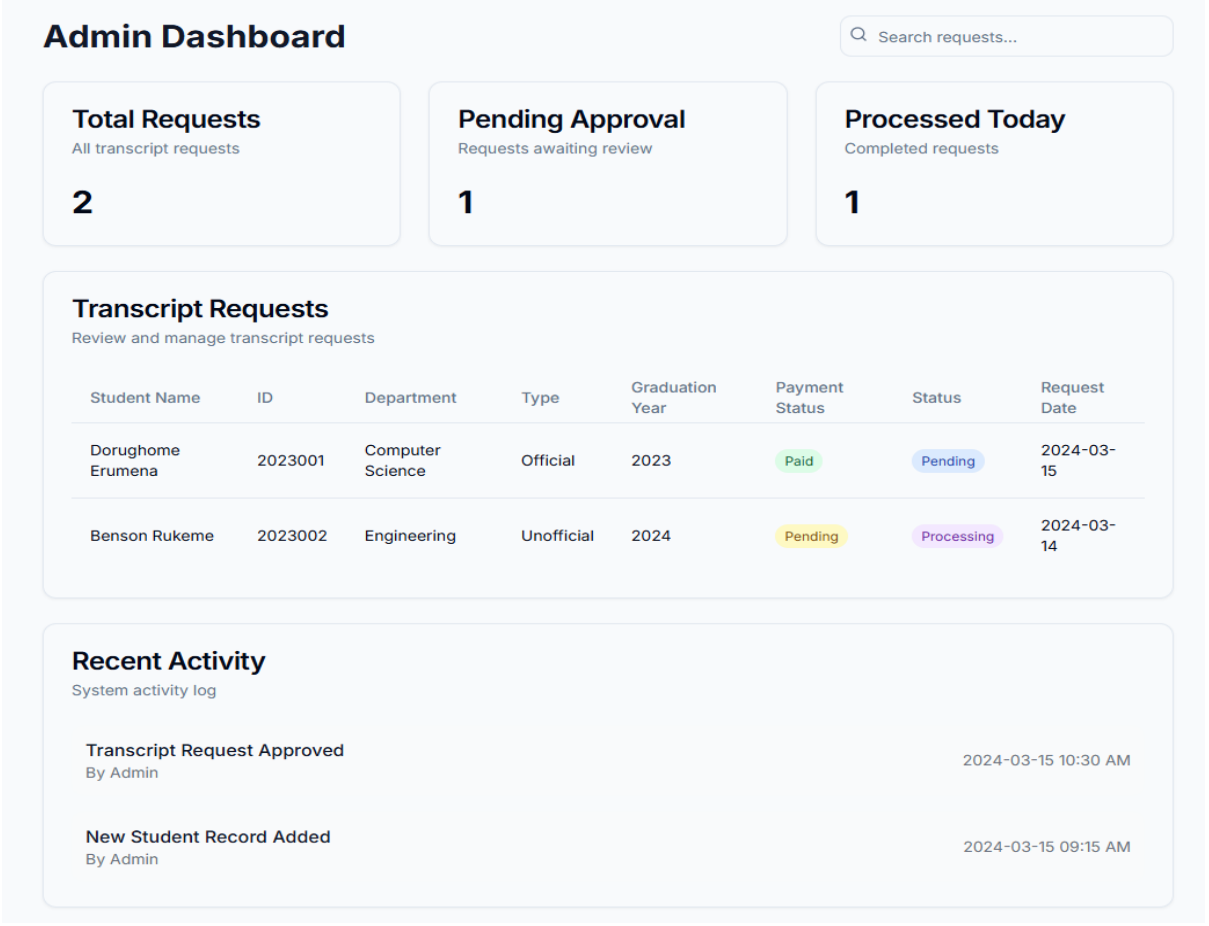

Figure 8:Admin Dashboard

Figure 9Grade Entry Screen**.**This form is for faculty members. Faculty members responsible for grade input access the Grade Entry Screen, where they input student grades for each semester. The interface presents a structured table listing all enrolled students in a course, along with corresponding grade entry fields.

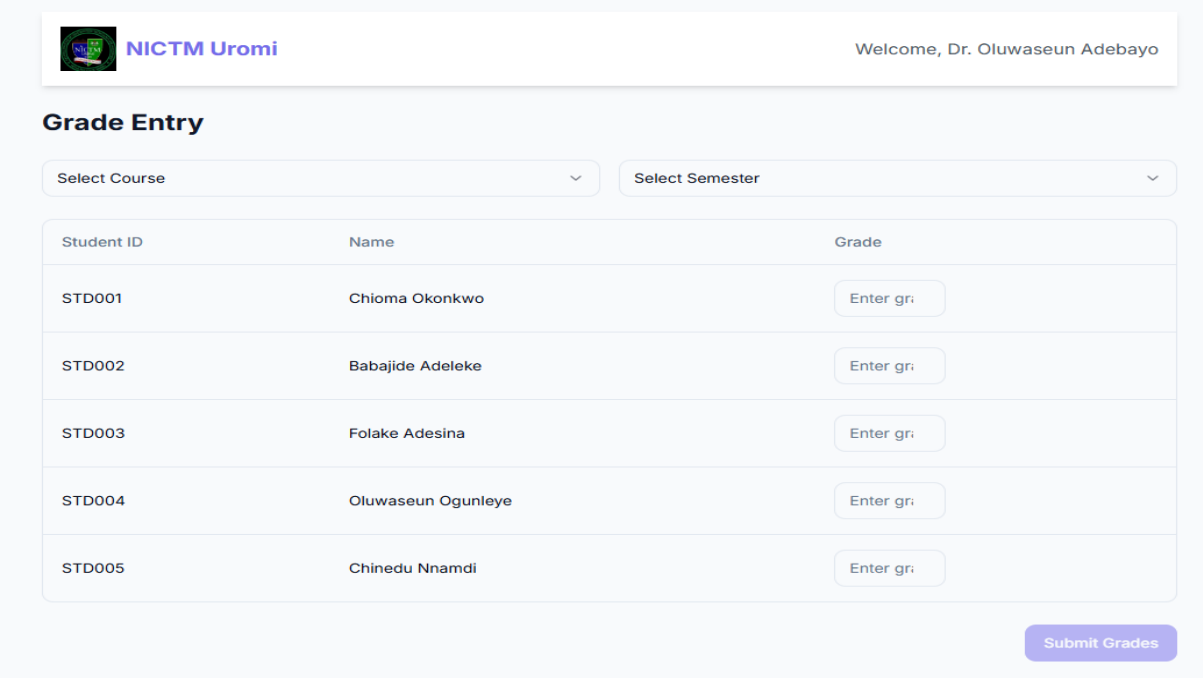

Figure 9: GradeEntry process

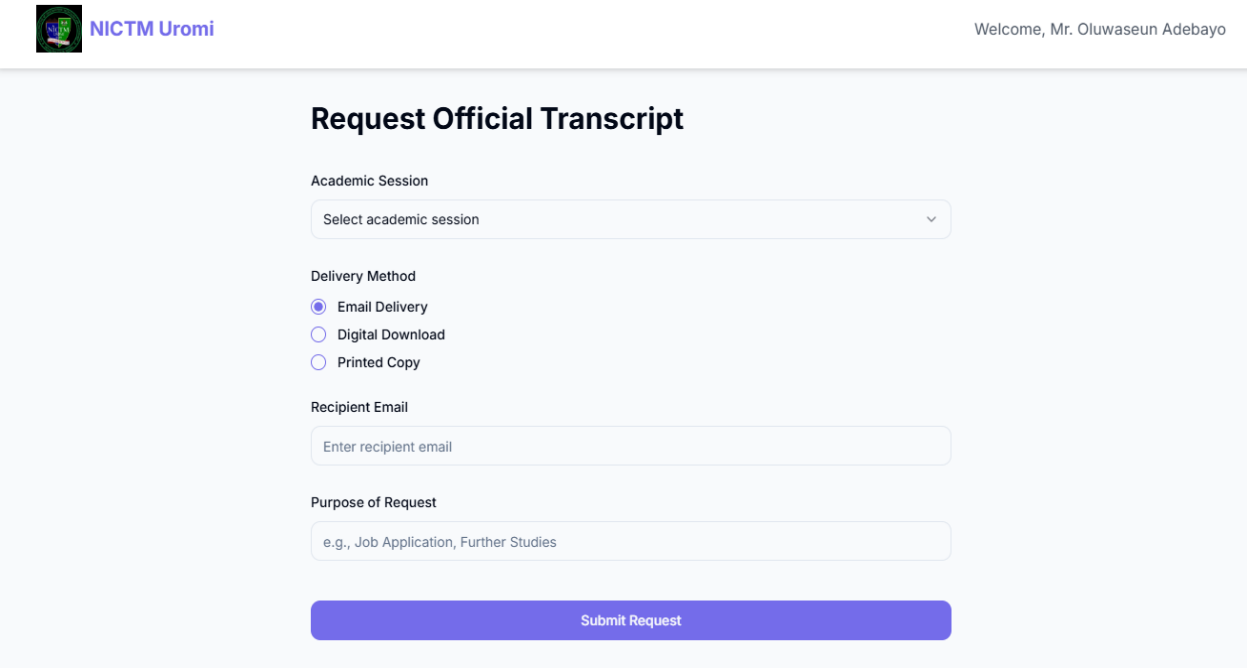

Figure 10: Transcript Request

Figure 11 Transcript Download. Upon successful approval, students can access their transcripts through the Transcript Download Screen.

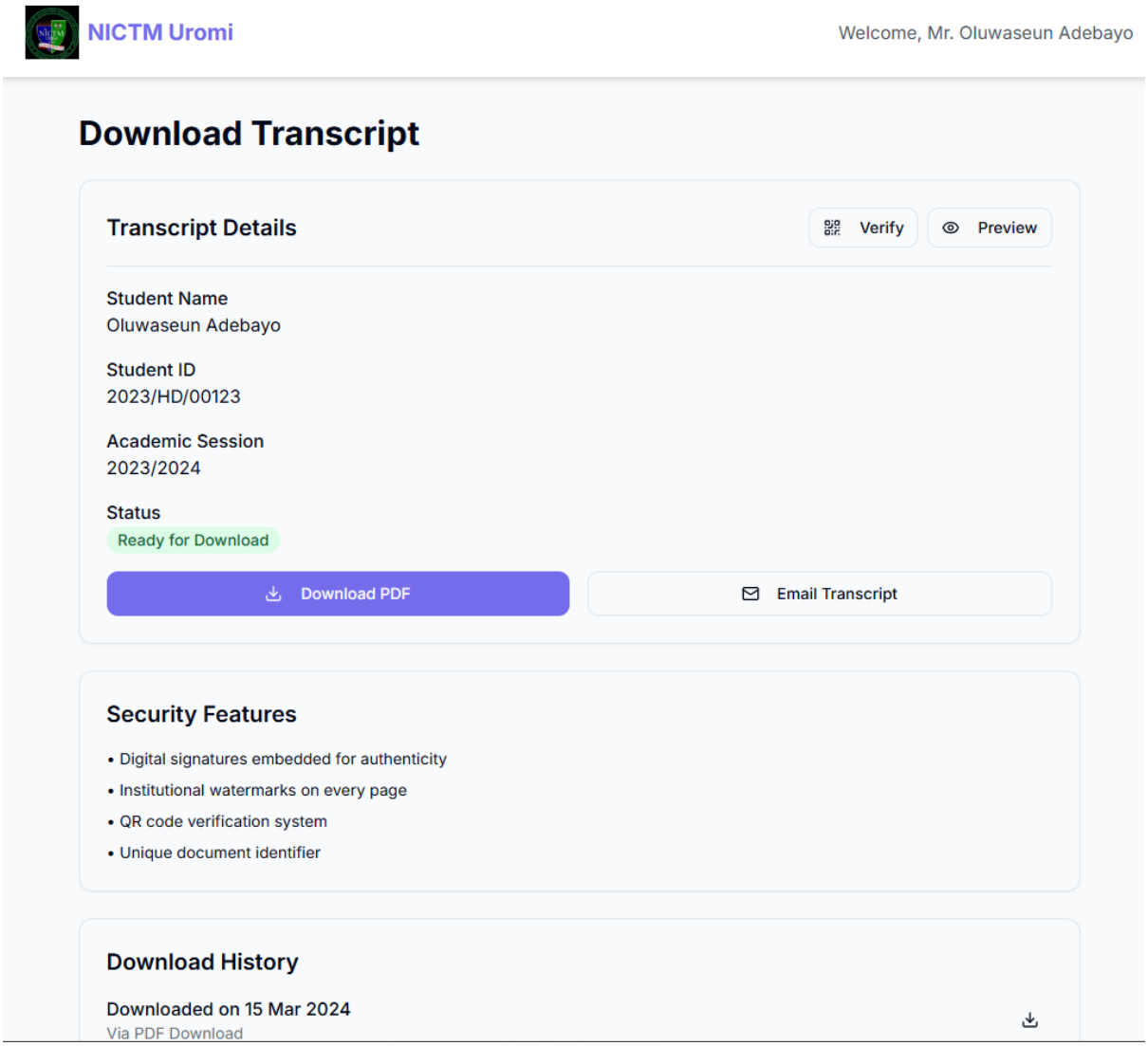

Figure 11: Transcript Download

CONCLUSION

The successful design and implementation of the Transcript Management System (TMS) at the National Institute of Construction Technology and Management, Uromi has significantly transformed academic record processing. The study identified key challenges in traditional transcript handling and developed an automated, secure, and scalable system that enhances efficiency and accessibility. Through functional, performance, and security testing, the system proved to be robust, reliable, and secure, ensuring that students, faculty, and administrators can manage academic records seamlessly. The implementation of real-time GPA calculations, transcript verification, and digital delivery options marked a major advancement in educational technology solutions. Future enhancements, such as blockchain integration, mobile applications,

and AI-powered analytics, could further improve the system, making it a benchmark model for transcript management in higher education institutions worldwide. Overall, this study has successfully automated transcript processing, improved security, and reduced administrative workload, contributing to a more efficient and modernized education system.

RECOMMENDATIONS

Although the system has successfully improved transcript management, the following enhancements are recommended for future improvements:

i. Integration with Other Educational Systems – The system should be integrated with Learning Management Systems (LMS) and Student Information Systems (SIS) to enable seamless data synchronization.

ii. Blockchain-Based Transcript Verification – Implementing blockchain technology can enhance security and prevent transcript forgery by providing tamper-proof academic records.

iii. Mobile Application Development – Developing a mobile-friendly application would increase accessibility for students, enabling them to request and download transcripts conveniently from their smartphones.

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