European Journal of Computer Science and Information Technology,13(3),20-42, 2025
Print ISSN: 2054-0957 (Print)
Online ISSN: 2054-0965 (Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Development of QR Code-Based Authentication System for Admitting Students into Examination Hall for Polytechnics in Nigeria

[1]Jude Alphonsus Inyangetoh, and [2]Ekemini Anietie Johnson
[1]Department of Statistics, Federal Polytechnic Ukana, Akwa Ibom State
[2] Department of Computer Science, Federal Polytechnic Ukana, Akwa Ibom State

doi: https://doi.org/10.37745/ejcsit.2013/vol13n32042 Published March 15, 2025

Citation: Inyangetoh J.A., and Johnson E.A. (2025) Development of QR Code-Based Authentication System for Admitting Students into Examination Hall for Polytechnics in Nigeria, *European Journal of Computer Science and Information Technology*,13(3),20-42

Abstract: *This study implements a QR code-based authentication system at Federal Polytechnic Ukana, Nigeria, as a technological solution to the challenges of traditional manual verification methods in examination management. The system architecture includes a database management module (MySQL), a QR code generation module (Python QR Code library), and an authentication module (Android mobile application). The system integrates web-based and mobile platforms, enhancing accessibility and usability. Advanced Encryption Standard (AES) is used to secure QR code data. The system undergoes rigorous testing to validate its functionality, accuracy, and security. A pilot deployment in two departments over a two-week examination period showed improved efficiency, reduced impersonation cases, and enhanced overall examination integrity. Performance metrics showed reduced verification time, increased accuracy, and system reliability under varying conditions. The findings confirm that QR code technology significantly enhances examination security and operational efficiency. However, challenges such as internet connectivity dependency and potential QR code tampering are acknowledged. Future research may explore the integration of biometric authentication and blockchain technology to strengthen security measures. The successful implementation at Federal Polytechnic Ukana provides a model for broader adoption, offering a scalable and cost-effective solution to modernize examination management across Nigerian polytechnics and beyond.*

Keywords: QR code, authentication, examination, polytechnic, random forest extreme gradient boosting

INTRODUCTION

Examination management is a cornerstone of academic administration in polytechnics and higher institutions, playing a pivotal role in ensuring fairness, security, and the smooth conduct of

assessments. It serves as the backbone of academic integrity, fostering trust in the certification process and upholding the reputation of educational institutions. However, the traditional manual processes for verifying student identities and granting access to examination halls have proven to be inadequate in addressing modern challenges. These manual approaches, often reliant on visual checks of student identity cards and attendance registers, are not only time-consuming but also prone to human error and manipulation.

Delays in verification processes can lead to disruptions in examination schedules, causing undue stress for students and staff alike. Furthermore, the reliance on manually inspected identity cards creates opportunities for security breaches such as impersonation, where one individual attempts to take an exam on behalf of another. Instances of forged identity cards and unauthorized entries into examination halls are not uncommon, further undermining the credibility of the examination process. Such lapses not only compromise the integrity of academic assessments but also diminish the confidence of stakeholders in the education system.

The advent of technology has provided an opportunity to address these issues through innovative and efficient solutions. Among these, Quick Response code (QR code) technology has emerged as a standout tool for identity verification in academic contexts. A QR code is a two-dimensional barcode capable of encoding data in a machine-readable format, such as alphanumeric text, URLs, or encrypted information. It is widely recognized for its ability to store large amounts of data in a compact format while being easily readable by devices such as smartphones, scanners, and cameras.

The versatility of QR codes has led to their widespread adoption across various industries, including retail, healthcare, transportation, and, increasingly, education. In the academic sphere, QR codes offer a practical and reliable solution for identity verification, enabling institutions to automate and streamline processes that were previously manual. Their inherent reliability minimizes errors, while their cost-effectiveness makes them an accessible choice even for institutions operating on tight budgets. The implementation of QR code technology represents a significant step forward in addressing the inefficiencies and security vulnerabilities of traditional examination management systems.

By integrating QR codes into examination management, institutions can enhance the efficiency, accuracy, and security of their processes, thereby safeguarding academic integrity and improving the overall examination experience for students and staff alike (Al-Ghonmein *et al.*, 2025). This paper delves into the potential of QR codes to revolutionize the admission process into examination halls, ensuring a secure, seamless, and technologically advanced system for Nigerian polytechnics and beyond.

The QR code-based authentication system builds upon empirical evidence from previous studies on identity verification methods and security measures. The development of a QR code-based authentication system offers a practical solution to streamline the process of clearing students into

examination halls while enhancing security and efficiency. By referencing previous research findings, the study is able to support its theoretical framework and guide the implementation of the authentication system.

The research aims to add to the current knowledge by suggesting the use of a QR code-based authentication system. This system uses modern technology to confirm students' identities and prevent cheating during exams. (Stets and Burke, 2000)

The remainder of the document is structured as follows: Section 2 presents reviewed related literature while the methodology is presented in section 3. The results and discussion of the system are in section 4 in detail and section 5 presents the conclusion of the study.

REVIEW OF RELATED LITERATURE

The review of related literature explores existing research and findings on QR code-based authentication systems, with a particular focus on their application in educational institutions and examination security. The literature emphasizes the potentials of QR codes to enhance security measures, streamline administrative processes, and improve user convenience in authentication systems.
The summary of literature reviewed on QR-code-based authentication systems is captured in Table 1.

Table 1: Summary of Literature on QR Code-Based Authentication Systems

Citation	Focus Area	Key Findings	Limitations
Nasir (2021)	QR Code-Based Secure Authentication for University Exams	Reduced exam impersonation and enhanced security.	Limited to small-scale implementation; scalability issues.
Ali and Farhan (2020)	Enhancing Payment Security with Dynamic QR Codes	Improved security of mobile payments, preventing reuse of QR codes.	Focused only on payment systems, not on educational applications.
Susukailo and Lakh (2018)	Access Control System Using QR Codes and Biometric Verification	Enhanced security for access control systems by combining two-factor authentication.	High implementation cost and technical complexity.
Liew (2021)	QR Code-Based Attendance System in Universities	Streamlined attendance tracking, reduced manual errors.	Relies heavily on smartphone availability.
Nabi (2017)	Comparative Study of Traditional ID Checks and QR Code Verification	Demonstrated increased security and speed with QR code verification.	Limited to small sample size; requires further large-scale testing.

Shruti et al. (2020)	Dynamic QR Codes for Secure Exam Entry	Prevented unauthorized access and QR code reuse.	Dependent on stable internet connection and server reliability.
Nuhi et al. (2020)	Classroom Attendance Tracking with QR Codes	Improved accuracy and efficiency of attendance tracking.	Potential privacy concerns with student data.
Wang et al. (2022)	Blockchain-Enabled QR Code Authentication	Increased data integrity and security through decentralization.	High computational overhead and complexity.
Hassan et al. (2020)	Time-Based QR Codes for Secure Authentication	Reduced risk of code reuse and improved time-specific security.	Requires synchronized time across devices.
Geteloma et al. (2019)	QR Code Authentication for E-Government Services	Enhanced security for accessing e-government services.	Limited by user acceptance and digital literacy.
Mwambeleko (2023)	QR Code and Fingerprint Systems for University Examinations Management	Improved examination attendance management and reduced impersonation.	Applicability limited to institutions with necessary infrastructure.
Ogirima (2022)	Securing Logins in Electronic Examination Systems Using QR Code Technology and Multiple Hashing Algorithms	Enhanced login security in e-exam systems, reducing unauthorized access.	Implementation complexity and potential user resistance.
Ataelfadiel (2023)	Enhancing Digital Security: A QR Code and OTP-Based E-Authentication System	Improved e-authentication security through two-factor authentication.	Dependence on user compliance and device compatibility.
Zhang et al. (2021)	QR Code-Based Mobile Payment System Security Analysis	Identified vulnerabilities in QR code payment systems and proposed mitigation strategies.	Focused on payment systems; findings may not directly apply to educational contexts.
Chen and Li (2020)	Secure Access Control Using Encrypted QR Codes	Enhanced access control security by utilizing encrypted QR codes.	Requires robust encryption management; potential usability issues.
Kumar et al. (2019)	QR Code-Based Smart Attendance System	Automated attendance tracking with real-time data processing.	Dependent on internet connectivity and

			susceptible to technical glitches.
Lee and Park (2018)	Two-Factor Authentication Using QR Codes and Biometrics	Increased authentication security by combining QR codes with biometric verification.	High implementation costs and potential privacy concerns.
Singh et al. (2020)	Dynamic QR Code Generation for Secure Document Sharing	Improved document security through dynamic QR code generation.	Limited to document sharing applications; scalability concerns.
Rahman and Hossain (2019)	QR Code-Based Secure Voting System	Enhanced voting security and voter verification using QR codes.	Implementation challenges in large-scale elections; requires voter education.
Patel and Shah (2021)	QR Code Authentication in IoT Devices	Improved IoT device authentication using QR code mechanisms.	Potential vulnerabilities in IoT environments; requires further research.

This synthesis of existing research underscores the transformative role of QR codes in fostering secure and efficient authentication systems in educational settings, particularly for examination security.

Overview of QR Code-Based Authentication Systems

QR codes are widely used for secure and efficient data encoding, offering benefits such as ease of use, cost-effectiveness, and scalability. Research has highlighted their integration with mobile devices and web-based platforms, enabling dynamic and real-time authentication solutions. These systems often incorporate additional security layers, such as encryption, tokenization, or biometric verification, to mitigate risks like unauthorized access and data breaches.

In the context of educational institutions, QR codes have been utilized for:

i. Student Identification: Digital ID cards using QR codes for attendance tracking and library access.
ii. Examination Security: Secure exam entry points and verification of exam materials using unique QR codes.
iii. Access Control: Restricting access to sensitive areas, such as examination halls, using QR code-based systems.

Studies demonstrate that QR code systems significantly reduce instances of malpractice by:

i. Providing unique, non-replicable identifiers for each student or examination material.
ii. Facilitating real-time validation and authentication via mobile applications.

iii. Enabling rapid reconfiguration and regeneration of codes to address security breaches.

Despite the advantages, QR code systems face challenges, such as:

i. Dependency on internet connectivity for real-time operations.
ii. Susceptibility to physical damage or tampering of printed QR codes.
iii. Risks of code cloning or unauthorized scanning in the absence of proper encryption.

METHODOLOGY

This section outlines study area, data collection and the systematic approach adopted for the development and evaluation of the QR Code-based authentication system designed to facilitate student admission into examination halls for polytechnics in Nigeria.This study used a case study approach with an emphasis on Federal Polytechnic Ukana's development of authentication system for admitting students into examination hall. The rationale for choosing this approach is that it can provide a thorough, in-depth analysis of a particular phenomenon in the context of real-world situations, which facilitates a full understanding of the subject matter (Harrison et al., 2017). Researchers can use this approach to examine how QR-code is used in student authentication within the specific setting of the Polytechnic, accounting for factors like stakeholder dynamics, organizational culture, and project constraints.

Agile software development methodology was adopted for this project due to its adaptability to changing requirements, making it particularly suitable for developing a QR code-based authentication system for admitting students into examination hall for polytechnics. Its iterative approach ensures regular feedback and collaboration with stakeholders, enabling the system to evolve in response to their needs. Additionally, Agile's emphasis on delivering functional software in short iterations aligns with the demand for timely updates and improvements in educational systems. By implementing Agile, the project team can effectively manage uncertainties, accommodate changes, and prioritize features based on their importance to end users, resulting in a more user-friendly and responsive system.

The data used in the study was obtained from Federal Polytechnic Ukana, Nigeria.
The systematic approach followed to develop and evaluate the QR Code-based authentication system consists of five key phases which are as follows:

i. Requirements Analysis: to establish the system’s functional and non-functional requirements, stakeholder consultation was conducted through interviews and questionnaires with academic staff, IT personnel, and students of Federal Polytechnic Ukana. Key functional requirements included real-time QR code scanning, verification of student identity, and secure data storage. Non-functional requirements emphasized scalability, usability, and system responsiveness.
ii. System Design: Modular system architecture was designed to ensure maintainability and scalability. The system comprised three primary components:

a. Database Management Module: developed using MySQL, it stores student records, examination schedules, and QR code information.
b. QR Code Generation Module: built using the Python QR Code library, it generates unique, encrypted QR codes for each student based on their examination schedule and ID details.
c. Authentication Module: implemented as a mobile application, this module performs QR code scanning, decryption, and verification using the student's database records.

iii. System Implementation: the system was implemented as a web-based platform with a companion Android mobile application for QR code scanning. Key tools and technologies used included:
   a. Frontend Development: HTML5, CSS3, and JavaScript for the user interface.
   b. Backend Development: Python and Django framework for server-side processing.
   c. Mobile Application: Android Studio and Java for QR code scanning and real-time authentication.
   d. Encryption was implemented using the Advanced Encryption Standard (AES) to secure QR code data. The system was hosted on a cloud-based server to ensure scalability and availability.

iv. Testing: the system was subjected to rigorous testing in three phases:
   a. Unit Testing: Each module was independently tested for functionality and correctness.
   b. Integration Testing: interaction between modules was validated to ensure seamless data flow and operation.
   c. System Testing: the complete system was tested under simulated real-world conditions, including varying internet speeds and usage loads.
   Key performance metrics included response time, system accuracy, and failure rate during QR code scanning and verification.

v. Evaluation: the system was deployed on a pilot basis in two departments of the case study over a two-week examination period. Evaluation metrics included:
   a. Usability Testing: Feedback from 20 invigilators and 200 students on system usability and user experience was collected through questionnaires and interviews.
   b. Effectiveness: The reduction in examination hall admission errors and impersonation cases was analyzed by comparing data from the pilot period with prior examination records.
   c. Security Analysis: Penetration testing was conducted to identify vulnerabilities, ensuring the robustness of the encryption and authentication processes.

The steps followed in developing the system ensured a robust development process, aligning the system with the specific needs of Nigerian polytechnics while adhering to international best practices in software engineering and ethical research.

The architectural design, use case and entity relationship diagrams, were developed to visualize system interactions and workflows. The diagrams are shown in Figure 1, 2 and 3 respectively.

The architecture shows the different components of the system and the relationship that exist between them.

The use case diagram is a visual representation that describes how a system interacts with external entities (actors) to achieve specific goals. It is part of the Unified Modeling Language (UML) and is primarily used for understanding, analyzing, and designing systems.

The Entity-Relationship Diagram (ERD) is a visual representation of the data and its relationships within a system. It is commonly used in database design and development.

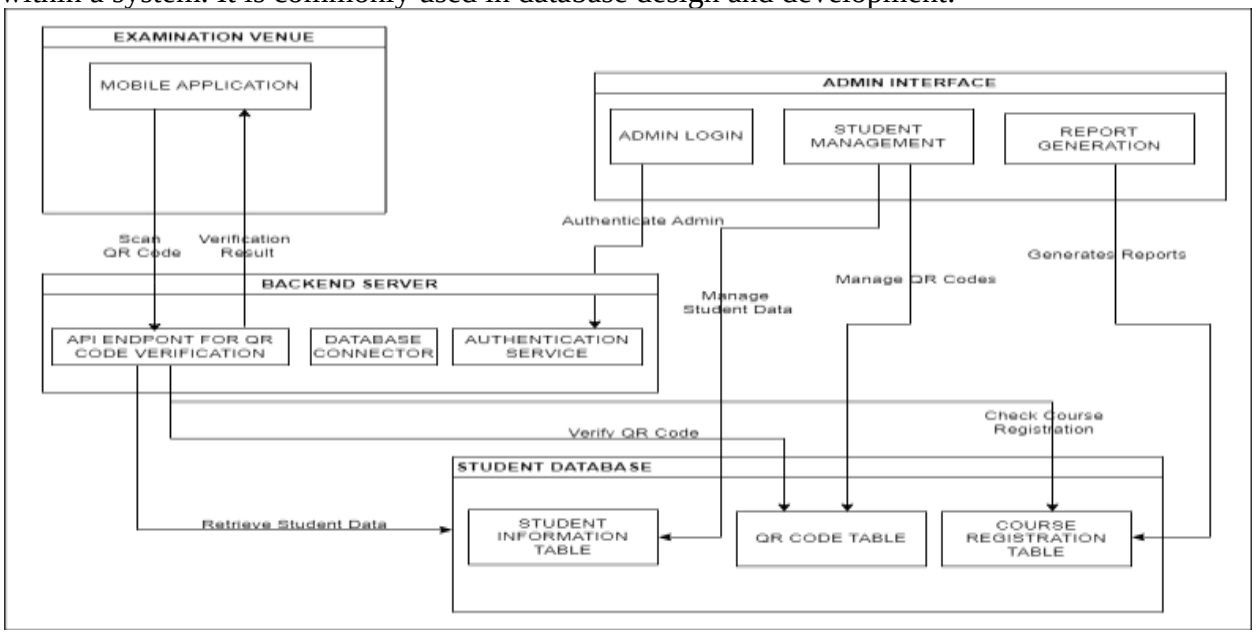

Figure 1: Architectural diagram of the system.

European Journal of Computer Science and Information Technology,13(3),20-42, 2025
Print ISSN: 2054-0957 (Print)
Online ISSN: 2054-0965 (Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

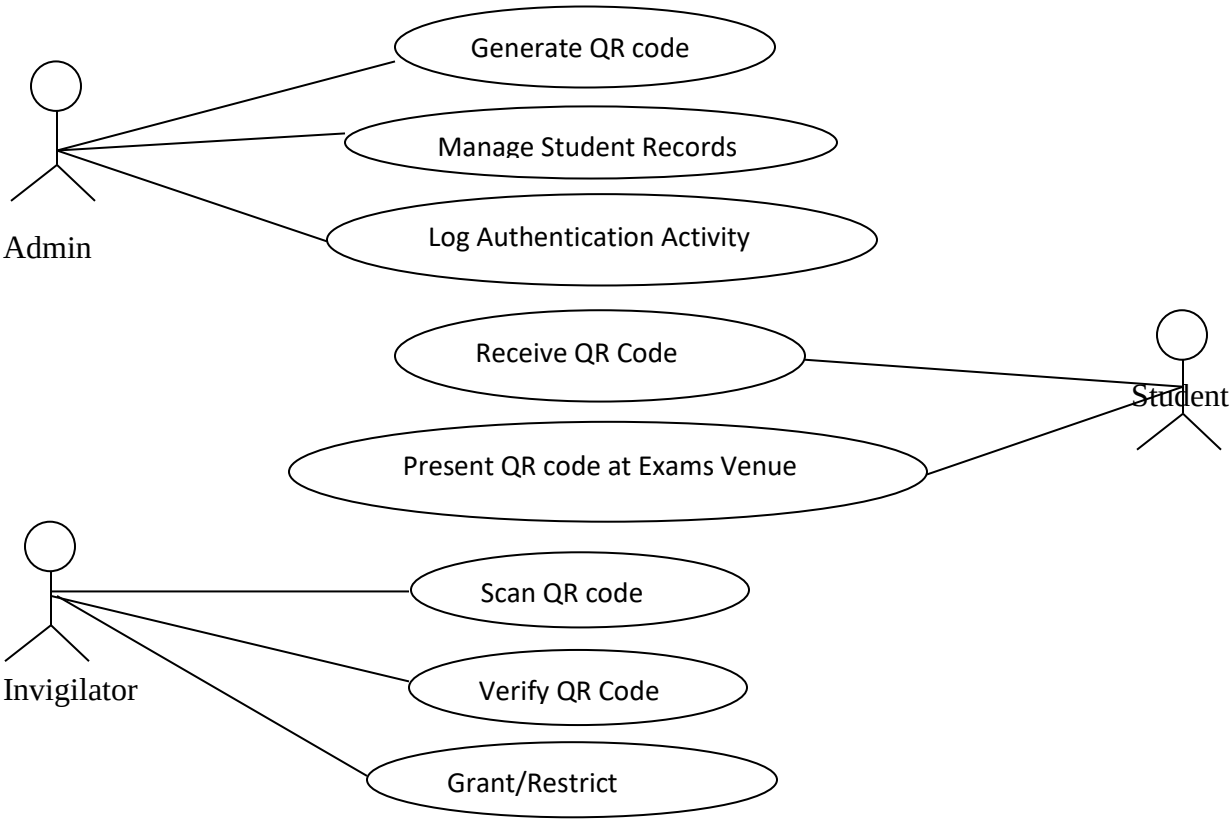

Figure 2: Use case diagram of the system

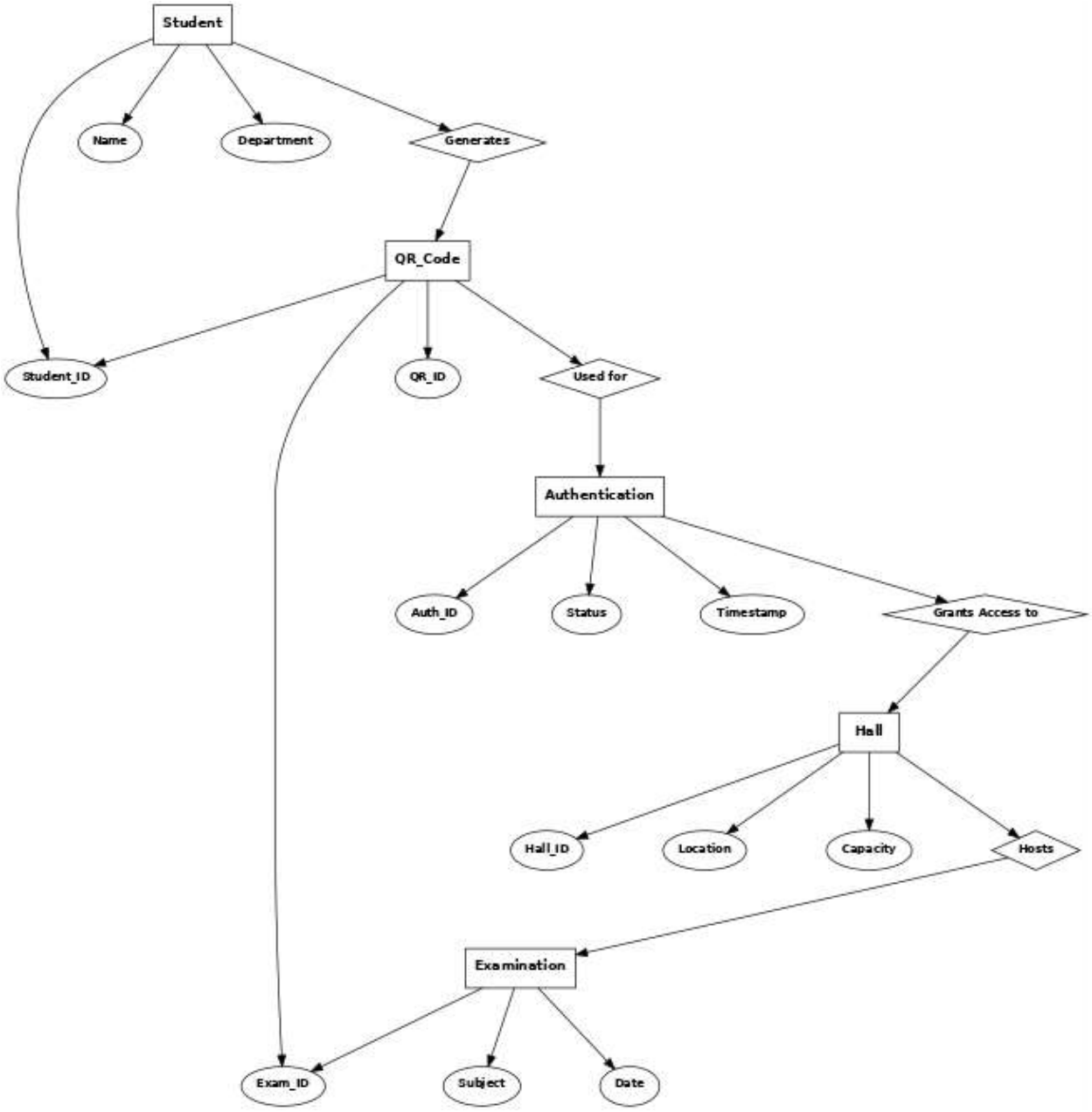

Figure 3: Entity Relationship diagram of the system

RESULTS AND DISCUSSION

This section presents the results of the research and this is done by showing outputs of the developed QR code-based authentication system for admitting students into examination hall for polytechnics in Nigeria.

Figure 4a is the Login Screen. The login screen ensures secure access to the system, allowing students and administrators to authenticate their identities. Users will enter their credentials, and the system will verify them before granting access. By integrating mobile technology, this system simplifies examination hall admission, reducing reliance on manual verification and preventing unauthorized access. The mobile app works in conjunction with a web-based platform, ensuring synchronization of student records and verification logs for an efficient and transparent process at Federal Polytechnic, Ukana.

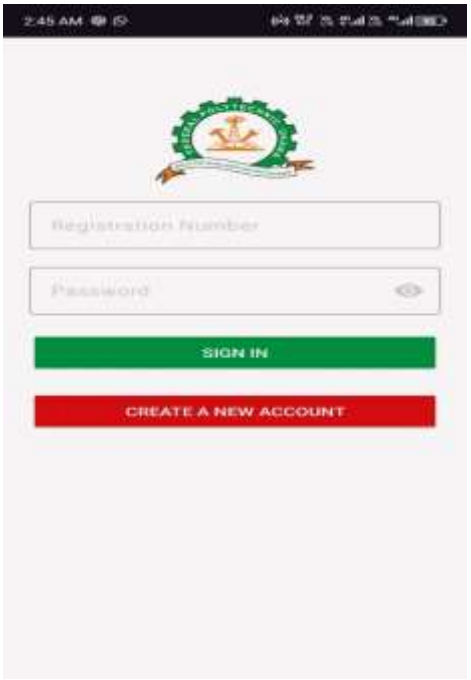

Figure 4a: Login Screen

Figure 4b and 4c represents another view of the login screen. This ensures an extra layer of security, safeguarding student data and maintaining system integrity. By leveraging mobile technology, this system enhances efficiency, security, and accuracy in examination hall admissions at Federal Polytechnic, Ukana. The mobile app works in sync with the web-based platform, ensuring real-time updates and a seamless authentication process.

European Journal of Computer Science and Information Technology,13(3),20-42, 2025
Print ISSN: 2054-0957 (Print)
Online ISSN: 2054-0965 (Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Figure 4b: Login Screen

Figure 4c: Login Screen

Figure 5 shows registration screen and Figure 6 shows successful registration. It is a crucial component of the QR code-based authentication system for admitting students into examination halls at Federal Polytechnic, Ukana. This interface allows students to sign up and create unique profiles before accessing the system. While Figure 6 depict registration completion

During the registration process, students provide essential details such as name, matriculation number, department, and level. The system securely stores this data and generates a unique QR code linked to the student's profile. This QR code will be used for authentication at the examination hall entrance.

The registration feature ensures that only verified and authorized students gain access to the system, enhancing security and minimizing cases of impersonation during examination

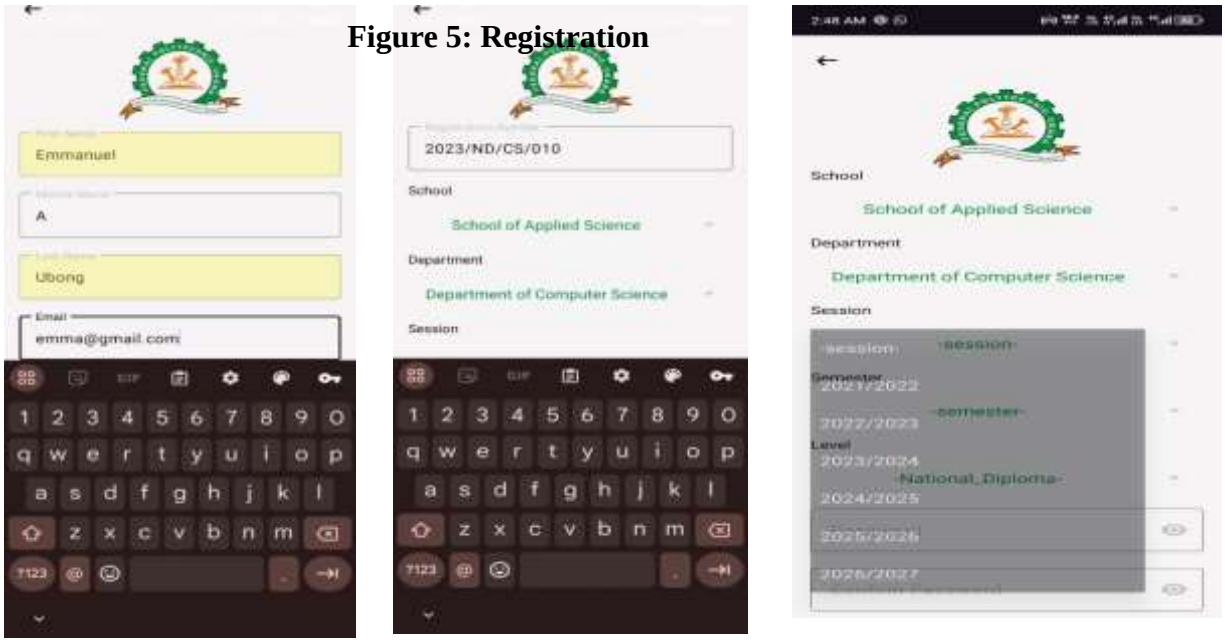

Figure 5: Registration

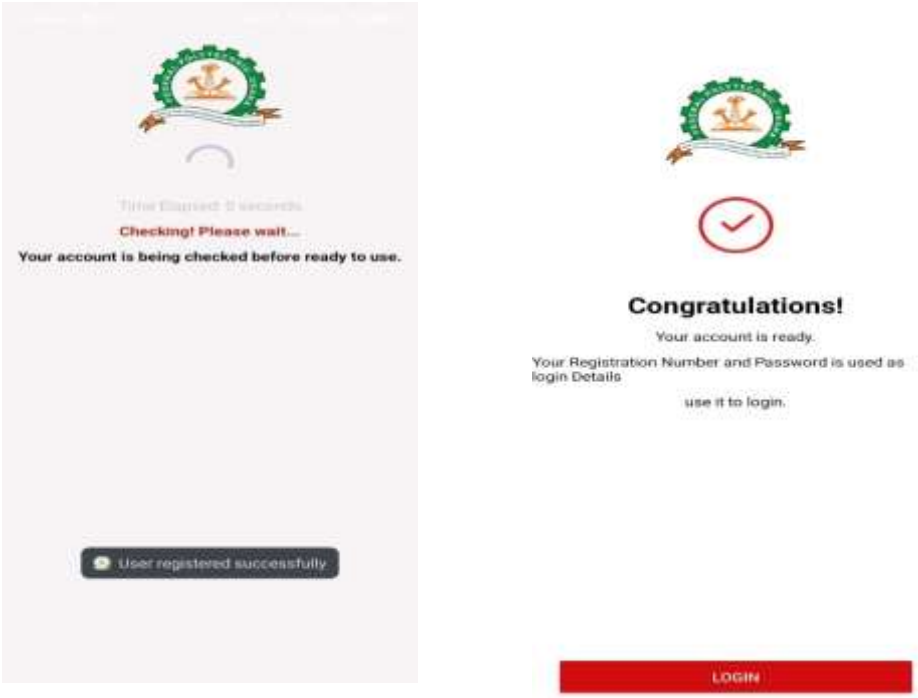

Figure 6: Successful Registration

The Admin/Examination Officer's Dashboard is a key component of the QR Code-Based Authentication System for admitting students into examination halls at Federal Polytechnic, Ukana. This dashboard is designed to provide administrators and examination officers with a

centralized platform for managing student authentication and examination hall access as depicted in Figure 7

The features of the Admin/Examination Officer Dashboard: are as follows:

a. Student Management – The dashboard enables administrators to oversee, authenticate, and manage registered students. It provides functionalities to review student information, approve registrations, and identify any suspicious activity, as illustrated in Figure 12.
b. QR Code Generation and Verification – Examination officers can generate and scan QR codes to authenticate students at the examination hall entrance, ensuring that only registered and authorized students gain access. This process is depicted in Figures 8 to 12.

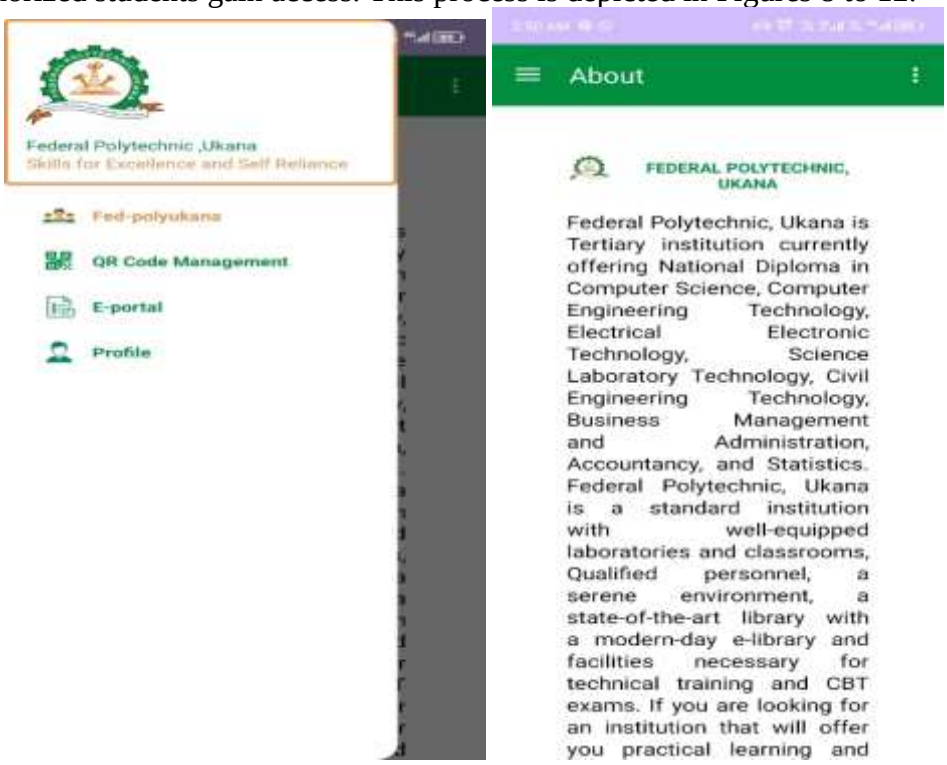

Figure 7: Dashboard

European Journal of Computer Science and Information Technology,13(3),20-42, 2025
Print ISSN: 2054-0957 (Print)
Online ISSN: 2054-0965 (Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

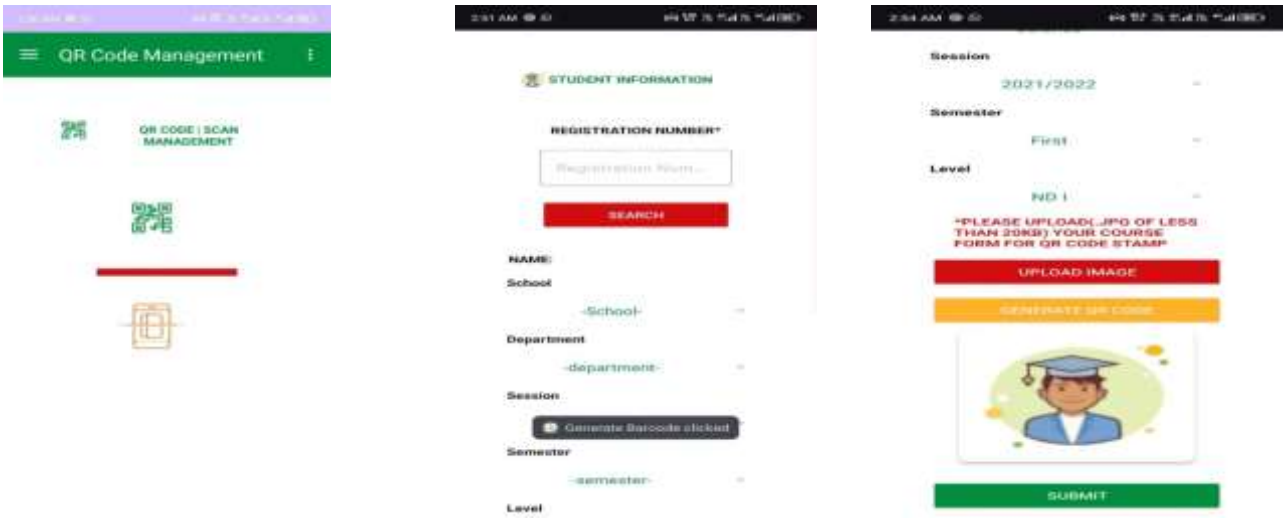

Figure 8 a: QR Code Generation

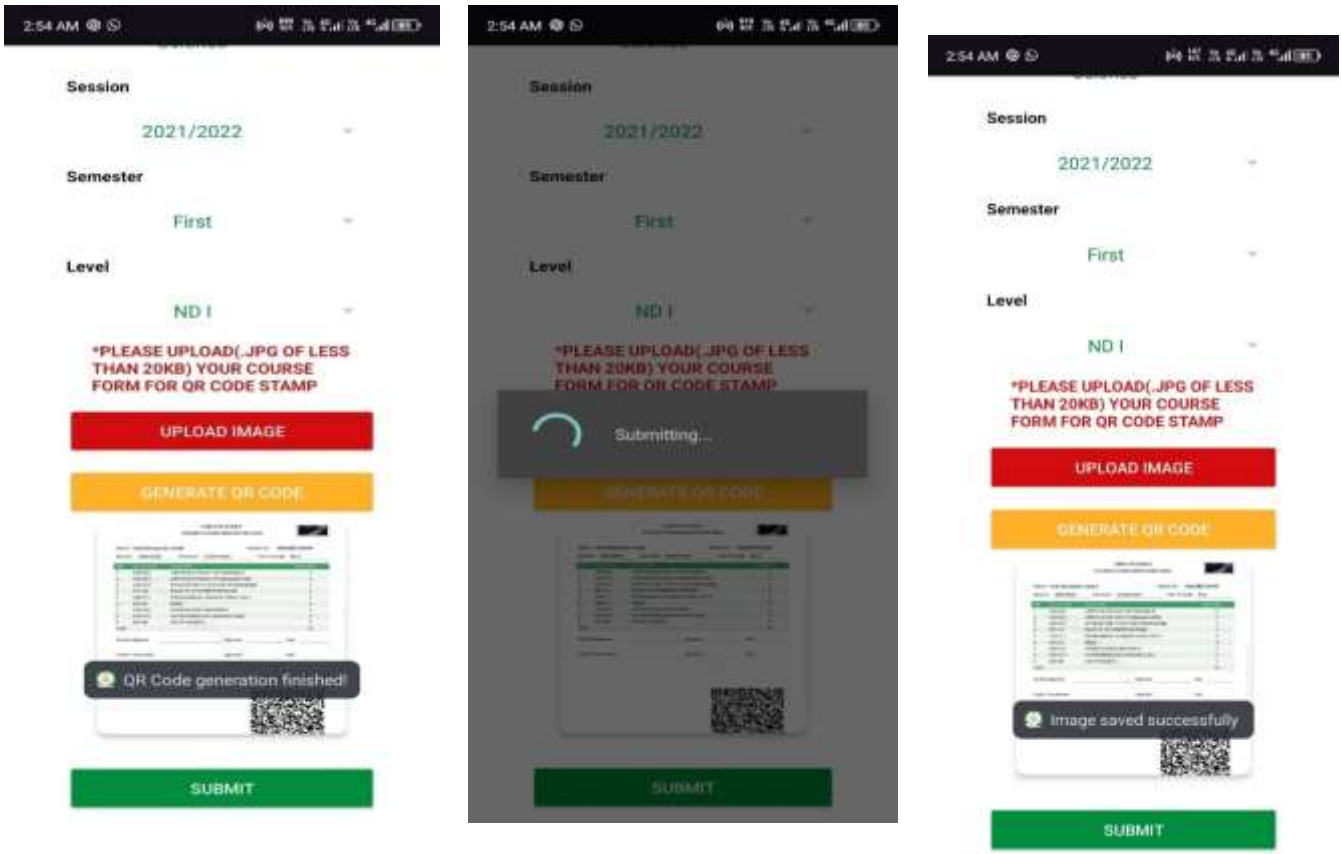

Figure 8b: QR Code Generation

Figure 9: Generated QR code

Figure 10a: QR code Scan

Figure 10b: QR code Scan Result

The student module provides access to a personalized dashboard where registered students can manage their examination authentication details. Within the dashboard, students can view their profile information and generate a unique QR code, which serves as their digital examination pass. This QR code can be downloaded and stored for easy access on the day of the examination. Upon arrival at the examination hall, students will present their QR code for scanning and verification by the examination officers, ensuring a secure and seamless authentication process. The process of generating and utilizing the QR code for examination access is illustrated in Figures 11 and 12.

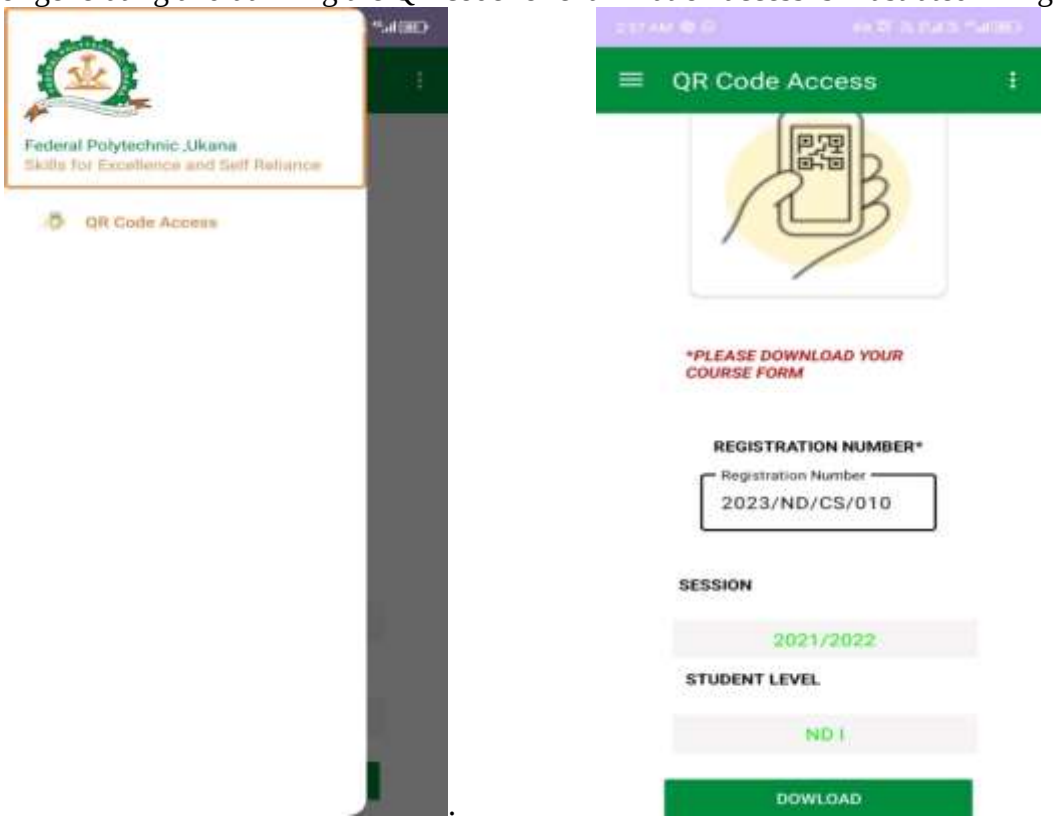

Figure 11: Student dashboard

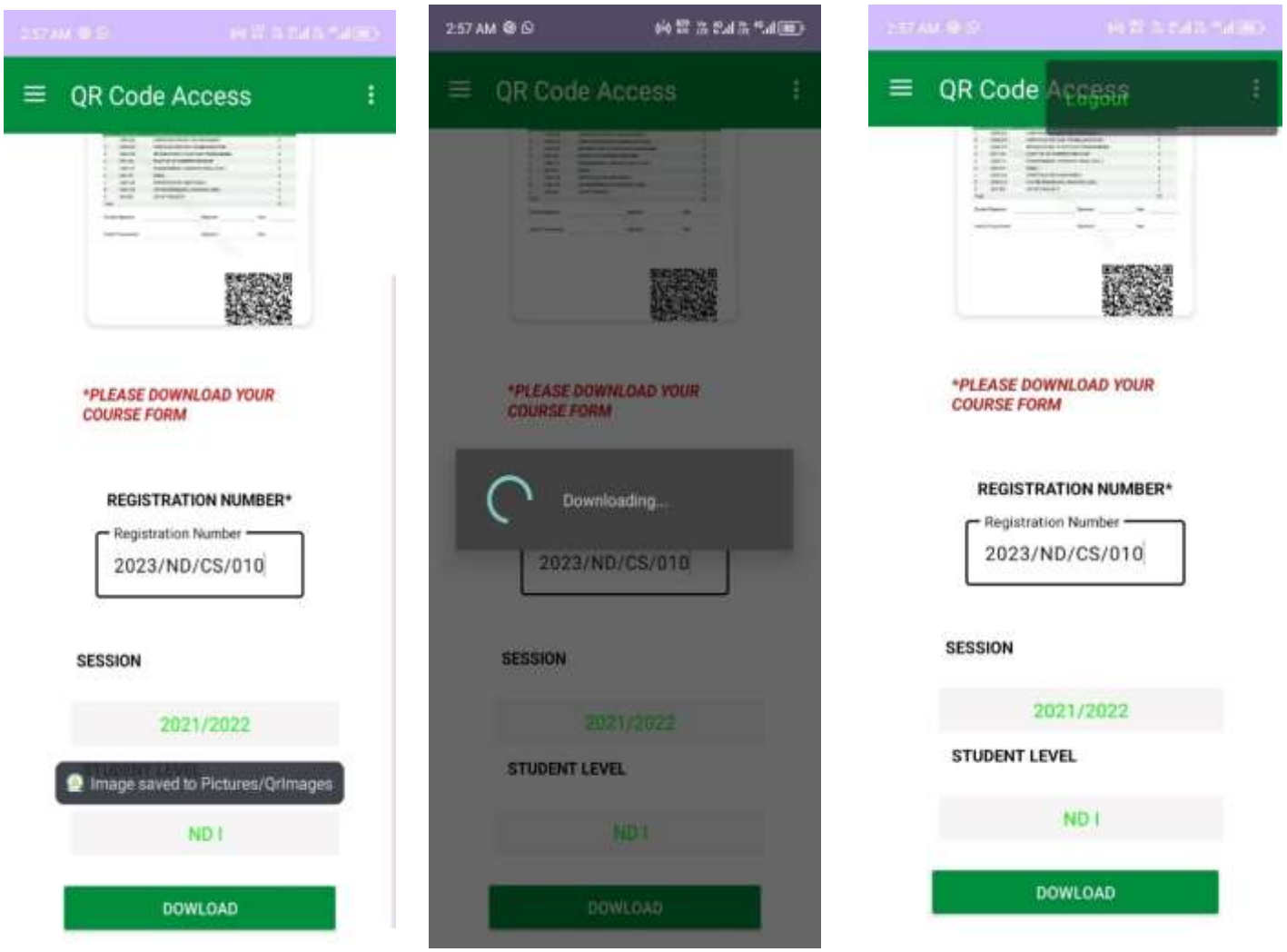

Figure 12: Course Form Download/ Logout

The system provides a special service that serves as the administrative platform for managing student authentication and examination access. It provides a secure and user-friendly interface for both administrators and examination officers to oversee student registrations, monitor authentication processes, and manage user roles.

Upon accessing the system, users are presented with the login page (Figure 13), where they enter their credentials for authentication. Once logged in, they are redirected to the dashboard (Figure 14), which provides an overview of system activities, including student records and examination access logs.

The system also features a QR code management module (Figure 15), where administrators can generate, assign, and verify QR codes linked to registered students. Additionally, the user

management section (Figure 16) enables administrators to oversee user accounts, update permissions, and ensure the integrity of the examination authentication process.

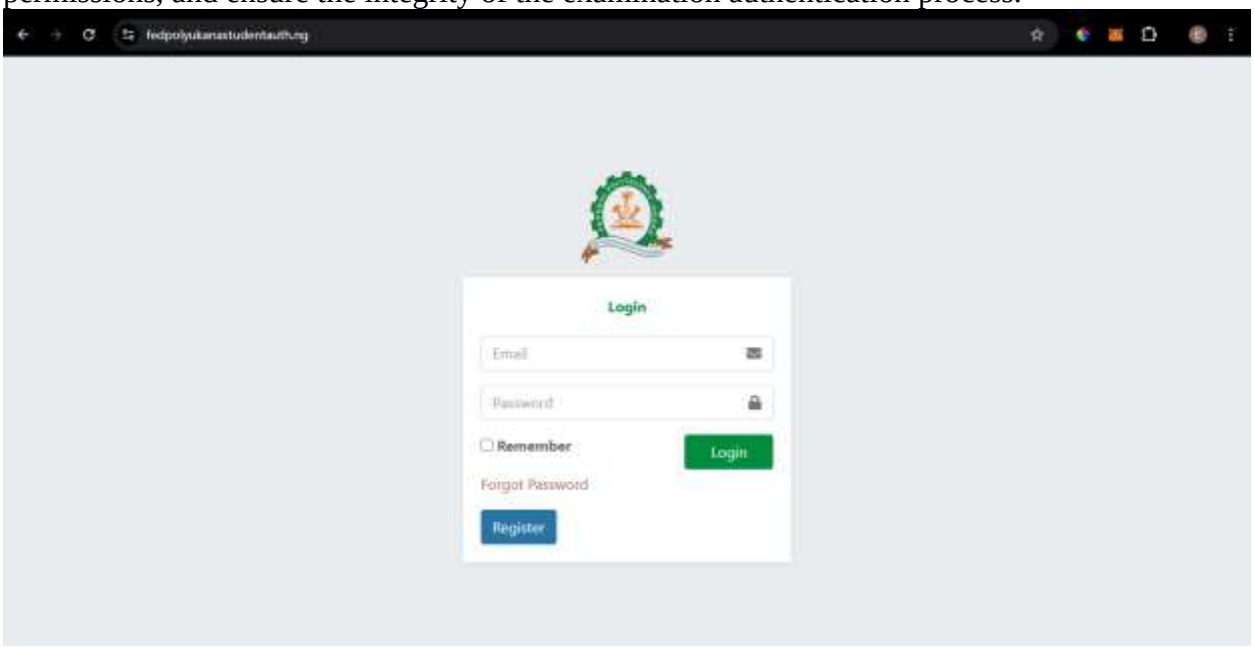

Figure 13: Admin Login

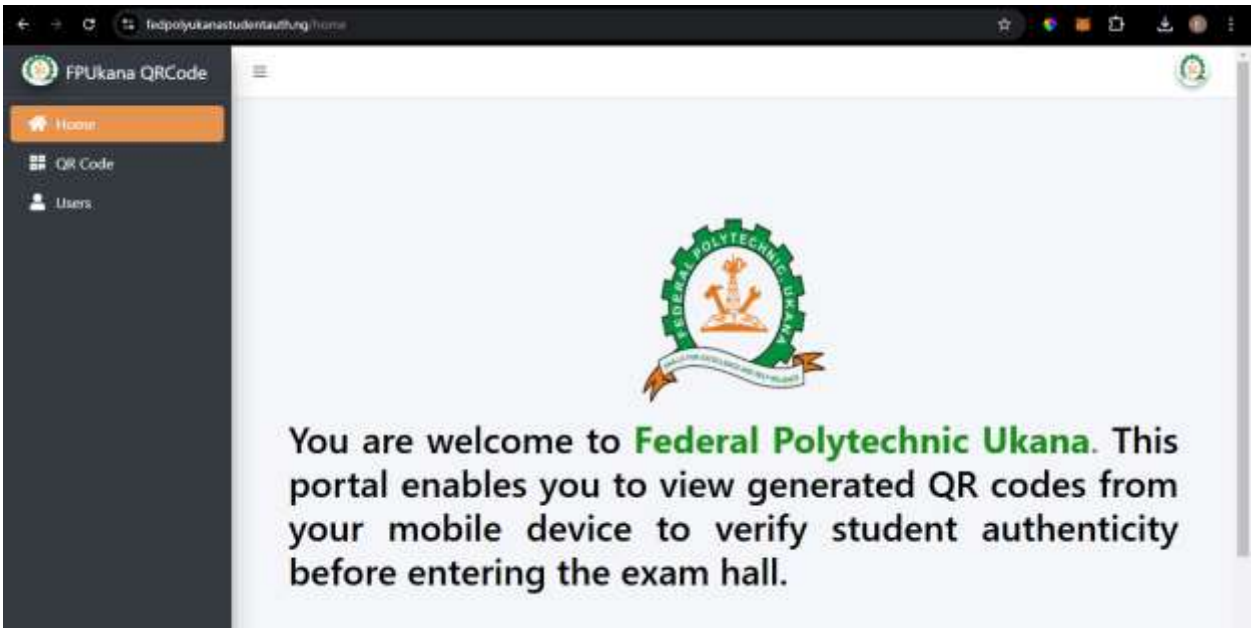

Figure 14: Admin Dashboard

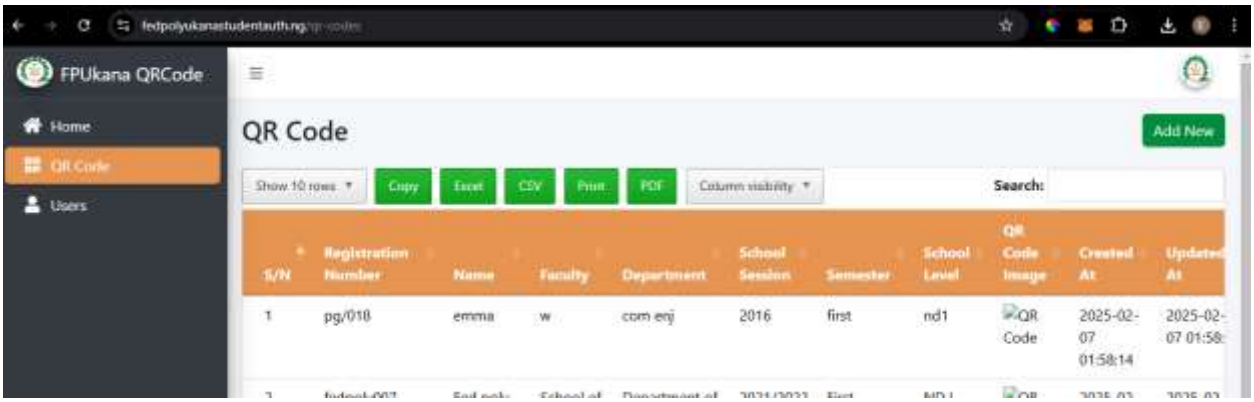

Figure 15: QR Details

Figure 16: User Management

CONCLUSION AND RECOMMENDATION(S)

The implementation of a QR code-based authentication system for examination hall admissions represents a significant advancement in addressing the challenges associated with traditional manual verification methods. This study has demonstrated that QR code technology provides a secure, efficient, and scalable solution that enhances examination integrity by reducing impersonation, streamlining admission processes, and minimizing administrative burdens.

By leveraging a structured methodology that included requirement analysis, system design, implementation, testing, and evaluation, the research ensured that the developed system met the specific needs of Nigerian polytechnics. The system's ability to generate and authenticate unique QR codes for students significantly improved the accuracy of identity verification while reducing delays and errors associated with manual checks. Furthermore, the integration of encryption

techniques ensured the security of student data, addressing concerns related to unauthorized access and data breaches.

Empirical evaluation through pilot testing at Federal Polytechnic Ukana confirmed the system's effectiveness in improving examination hall security and operational efficiency. The feedback collected from students and invigilators highlighted the system's ease of use and reliability, reinforcing its practical applicability in real-world academic settings. Additionally, performance metrics such as response time, accuracy, and system uptime demonstrated the robustness of the system under varying conditions.

Despite its numerous advantages, the study acknowledges certain challenges, including the reliance on stable internet connectivity and the potential risks of QR code tampering. Future research could explore the integration of additional security layers, such as biometric authentication and blockchain technology, to further enhance the system's reliability and resistance to fraud.

Overall, the findings of this study underscore the transformative potential of QR code-based authentication systems in educational institutions. By adopting such technological solutions, polytechnics and higher institutions can significantly improve their examination management processes, ensuring fairness, security, and academic integrity. The successful implementation of this system at Federal Polytechnic Ukana serves as a model for broader adoption in other institutions, contributing to the modernization and digitization of academic administration in Nigeria and beyond.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Funding
The following financial assistance was revealed by the author(s) for the research, authoring, and/or publishing of this article: The Tertiary Education Trust Fund (TETFUND) provided funding for this study via the Institution Based Research Fund (IBRF).

Acknowledgments
The authors are grateful to Federal Polytechnic Ukana, Akwa Ibom State for providing a conducive environment for the conduct of this research.

REFERENCES

Al-Ghonmein, A. M., Alemami, Y., Al-Moghrabi, K. G., & Atiewi, S. (2025). Enhancing online exam security: encryption and authentication in Jordanian and international universities. International Journal of Electrical & Computer Engineering (2088-8708), 15(1).

Ali, A. M., & Farhan, A. K. (2020). Enhancement of QR code capacity by encrypted lossless compression technology for verification of secure E-Document. *IEEE Access*, *8*, 27448-27458

Ataelfadiel, M. A. M. (2023). Enhancing Digital Security: A QR Code and OTP-Based E-Authentication System. *International Journal of Intelligent Systems and Applications in Engineering*, 11(4), 911–915

Chen, H., & Li, X. (2020). Secure Access Control Using Encrypted QR Codes. *IEEE Access*, 8, 123456–123465.

Geteloma, V., Ayo, C. K., & Goddy-Wurlu, R. N. (2019). A proposed unified digital id framework for access to electronic government services. In Journal of Physics: Conference Series (Vol. 1378, No. 4, p. 042039). IOP Publishing.

Harrison, H., Birks, M., Franklin, R., & Mills, J. (2017). Case study research: Foundations and methodological orientations. In Forum qualitative Sozialforschung/Forum: qualitative social research (Vol. 18, No. 1).

Hassan, M. A., Shukur, Z., & Hasan, M. K. (2020). An improved time-based one time password authentication framework for electronic payments. Int. J. Adv. Comput. Sci. Appl, 11(11), 359-366.

Kumar, R., Gupta, S., & Sharma, P. (2019). QR Code-Based Smart Attendance System. *International Journal of Recent Technology and Engineering (IJRTE)*, 8(3), 123–127

Lee, S., & Park, J. (2018). Two-Factor Authentication Using QR Codes and Biometrics. *Journal of Information Processing Systems*, 14(6), 1453–1464.

Liew, K. J., & Tan, T. H. (2021). QR code-based student attendance system. In 2021 2nd Asia Conference on Computers and Communications (ACCC) (pp. 10-14). IEEE.

Mwambeleko, D. (2023). QR Code and Fingerprint Systems for University Examinations Management. *International Journal of Advances in Scientific Research and Engineering (IJASRE)*, 9(12), 37–48.

McCrary, H. C., Colbert-Getz, J. M., Poss, W. B., & Smith, B. K. (2021). A systematic review of the relationship between in-training examination scores and specialty board examination scores. Journal of graduate medical education, 13(1), 43-57.

Nabi, A. G. (2017). Comparative study on identity management methods using blockchain. University of Zurich, 118.

Nasir, M. A. (2021). QR Code Based Examination Card Verification System (A Case Study Of Ksusta). International Journal of Natural and Applied Sciences (IJNAS), 8(12), 27-34.

Nuhi, A., Memeti, A., Imeri, F., & Cico, B. (2020). Smart attendance system using qr code. In *2020 9th mediterranean conference on embedded computing (MECO)* (pp. 1-4). IEEE.

Ogirima, S. A. O. (2022). Securing Logins in Electronic Examination Systems for Tertiary Institutions Using Quick Response Code (QR) Technology and Multiple Hashing Algorithms. *International Journal of Computer Science and Information Security (IJCSIS)*, 20(4), 15–25.

Patel, D., & Shah, M. (2021). QR Code Authentication in IoT Devices. *International Journal of Engineering Research & Technology (IJERT)*, 10(6), 450–470

Rahman, M. A., & Hossain, M. S. (2019). QR Code-Based Secure Voting System. *International Journal of Computer Science and Network Security (IJCSNS)*, 19(5), 112–118

Stets, J. E., & Burke, P. J. (2000). Identity theory and social identity theory. Social psychology quarterly, 224-237.

Singh, A., Verma, R., & Gupta, N. (2020). Dynamic QR Code Generation for Secure Document Sharing. *International Journal of Computer Applications*, 176(30), 25–30.

Susukailo, V., & Lakh, Y. (2018). Access control system based on encryption in QR-Code technology. In 2018 IEEE 4th international symposium on wireless systems within the international conferences on intelligent data acquisition and advanced computing systems (IDAACS-SWS) (pp. 158-161). IEEE.

Stets, J. E., & Burke, P. J. (2000). Identity theory and social identity theory. Social psychology quarterly, 224-237.

Shruti, M. I., Pratiksha, M. K., Jyoti, M. M., Snehal, M. N., & Vaibhav, P. D. (2020). Designing Security Framework for Secure Exam System based on QR Code. *International Journal for Research in Applied Science & Engineering Technology*, *8*(6), 1692-1697.

Wang, L., He, Y., & Wu, Z. (2022). Design of a blockchain-enabled traceability system framework for food supply chains. Foods, 11(5), 744.

Zhang, Y., Wang, X., & Liu, J. (2021). QR Code-Based Mobile Payment System Security Analysis. *Journal of Information Security and Applications*, 58, 102791.