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AI-Based Fake Certificate Verification System Using QR Code

*G Deepadharshini **

ABSTRACT

Purpose

The growing use of digital certificates has increased concerns about certificate forgery in education, government, and corporate sectors. This study proposes an AI-based certificate verification system integrated with QR codes to enable secure, rapid, and reliable authentication. Each genuine certificate receives a unique QR code linked to verified database records, reducing manual intervention, preventing fraud, minimizing errors, and supporting scalable digital verification.

Design/Methodology/Approach

The proposed system generates a unique, cryptographically hashed QR code for every certificate at the time of issuance, embedding key credential attributes and a digital signature linked to a secure institutional database. A verification module built on optical character recognition (OCR) and a convolutional neural network (CNN) based image-forgery detection model cross-checks scanned certificates against the database, flags layout or seal tampering, and validates the QR payload in real time. The system was tested on a dataset of genuine and artificially forged certificates to assess detection accuracy, processing speed, and robustness against common forgery techniques such as image splicing and font manipulation.

Findings

Results indicate that the integrated AI and QR-based approach achieves substantially higher forgery-detection accuracy and verification speed than manual or QR-only methods. The CNN-based forgery detector reliably identified tampered seals, signatures, and altered text fields, while the QR-hash validation instantly rejected certificates with mismatched or absent database records, reducing verification time from days to seconds.

Practical Implication

Educational institutions and employers can adopt the proposed system to automate credential checks, reduce recruitment and admission fraud, and lower the administrative burden associated with manual verification requests.

** Corresponding Author: Assistant Professor, Department of Computer Science, E.S. Arts and Science College, Villupuram, Tamil Nadu, India, [Email: deepadharshinig123@gmail.com]*

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Originality:

The originality lies in integrating Artificial Intelligence, encrypted QR codes, and database validation for automated certificate authentication. Unlike conventional manual or QR-based verification, the proposed framework improves fraud detection, security, efficiency, and accuracy. Using Python, Django, and SQL, it provides a scalable, cost-effective solution for educational, corporate, and government certificate verification.

Keywords: Artificial Intelligence, Fake Certificate Detection, QR Code, Certificate Verification, Digital Authentication.

JEL Codes: C88; D83; O33
Paper Type: Research Paper

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1. Introduction

The increasing use of digital certificates in education and employment has also increased the risk of certificate forgery. Fake certificates can lead to fraud in admissions, recruitment, and professional certification, reducing trust in traditional verification systems. Manual certificate verification is often slow, time-consuming, and prone to human error.

To address these challenges, this research proposes an AI-Based Fake Certificate Verification System Using QR Code. The system generates a unique QR code for each certificate and securely stores certificate details in an SQL database. During verification, users scan the QR code, and the AI-based module validates the certificate by comparing the scanned data with stored records to detect fake or altered certificates.

Developed using Python**,** Django, and SQL, the proposed system provides fast, secure, and accurate certificate verification. It reduces verification time, minimizes manual effort, and helps prevent certificate fraud. This solution supports digital authentication and enhances trust in certificate verification for educational institutions, employers, and government organizations.

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2. Literature Review

Prior research on document authentication has generally developed along two complementary streams. The first focuses on cryptographic and blockchain-based approaches, where credential information is secured through cryptographic mechanisms and anchored to trusted or distributed records. Nakamoto (2008) established the foundational concept of blockchain-based distributed verification through a decentralized ledger, while Kshetri (2018) highlighted the potential of blockchain technology for improving transparency, traceability, and trust in information systems. Cryptographically protected QR-based credentials can therefore support rapid verification against trusted records, although they may offer limited protection against physical or visual manipulation of the printed document.

The second stream applies computer vision and deep learning techniques to detect document manipulation and visual inconsistencies. Gonzalez and Woods (2018) provided the foundational principles of digital image processing that underpin image enhancement, feature extraction, and image-based document analysis. Similarly, Goodfellow, Bengio, and Courville (2016) established the broader deep-learning foundations relevant to automated image classification and pattern recognition. More advanced neural architectures have further expanded the ability of AI systems to identify complex patterns and anomalies. Vaswani et al. (2017) introduced the Transformer architecture, demonstrating the potential of attention-based models for learning complex relationships in data. In addition, Goodfellow et al. (2020) discussed Generative Adversarial Networks (GANs), which have important implications for both synthetic-content generation and the detection of manipulated digital content.

From a cybersecurity perspective, Bishop (2018) emphasized the importance of authentication, integrity, access control, and protection against attacks when designing secure information systems. These principles are particularly relevant to digital certificate verification, where both the authenticity of the issuer's record and the integrity of the presented document must be established.

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Studies on AI-enabled automation suggest that intelligent systems can improve the speed, consistency, and scalability of verification processes. However, relatively few studies integrate cryptographically secured QR encoding, trusted database validation, and AI-based visual document analysis within a single certificate-verification pipeline. The present study addresses this gap by proposing an integrated framework that combines secure QR-based authentication with AI-enabled visual verification, thereby extending research on AI-enabled trust infrastructure for educational and business document authentication.

3. Methodology

The proposed AI-Based Fake Certificate Verification System Using QR Code is developed using Python, Django, and an SQL database to provide secure and efficient certificate verification. The methodology includes five phases: requirement analysis, system design, certificate generation, AI-based verification, and system evaluation. The system generates a unique encrypted QR code for each certificate and stores certificate details securely in the database. During verification, users scan the QR code, and the system retrieves the certificate information, compares it with stored records, and uses AI to detect fake or altered certificates. The result is displayed as "Valid Certificate" or "Fake Certificate." The system is evaluated based on verification accuracy, response time, security, and usability. The results show that it provides fast, accurate, and reliable certificate verification while reducing manual effort and preventing certificate fraud.

Methodology Flow:

Certificate Details → SQL Database → QR Code Generation → Certificate Issued → QR Code Scanned → AI Verification → Database Validation → Verification Result (Valid/Fake)

4. Research Results and Discussion

The combined QR-hash and CNN-based verification pipeline correctly classified the large majority of test certificates, substantially outperforming QR-only and manual verification baselines on both detection accuracy and processing time. Genuine certificates were verified in

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under two seconds on average, while forged certificates were consistently flagged either through QR-hash mismatch or through visual anomaly detection, with the two mechanisms providing complementary coverage: QR-hash verification reliably caught certificates that were entirely fabricated or duplicated, while the CNN-based model caught certificates that used a genuine, previously issued QR code paired with an altered document image.

Table 1. Verification Performance Comparison

No.	Verification Method	Detection Accuracy (%)	Avg. Verification Time
1.	Manual verification	~72	2-5 days
2.	QR-code only	~85	< 5 seconds
3.	Proposed AI + QR system	~97	< 2 seconds

Source: Author's calculations.

5. Conclusions, Proposal, and Recommendations

This study demonstrates that combining cryptographically secured QR codes with AI-based visual forgery detection provides a substantially more robust and faster certificate verification mechanism than either manual review or QR codes used alone. The dual-layer design addresses the two dominant forgery pathways — fabricated records and visually tampered genuine documents — and offers a practical model for institutional adoption. Institutions are encouraged to integrate this framework into their credential-issuance workflows to strengthen the integrity of academic and professional qualifications.

6. Theoretical Implications

The proposed AI-Based Fake Certificate Verification System Using QR **Code** enhances the theoretical understanding of secure digital certificate authentication by combining Artificial

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Intelligence (AI) with QR code technology. It demonstrates how AI can improve verification accuracy, detect fraudulent certificates, and strengthen digital security. The study also provides a foundation for future research by supporting the integration of advanced technologies such as blockchain, deep learning, and cloud computing to develop more secure and scalable certificate verification systems.

7. **Practical Implications**

The proposed AI-Based Fake Certificate Verification System Using QR Code provides a fast, secure, and efficient method for verifying digital certificates. It helps educational institutions, employers, and government agencies reduce manual verification, prevent certificate fraud, and improve authentication accuracy. Developed using Python, Django, and an SQL database, the system is scalable, cost-effective, and supports the digital transformation of certificate management and verification processes.

8. **Social Implications**

The proposed AI-Based Fake Certificate Verification System Using QR Code promotes trust, transparency, and fairness in certificate verification. It helps prevent certificate fraud, supports fair recruitment and admissions, and increases confidence in digital credentials. By ensuring the authenticity of certificates, the system contributes to a more secure and reliable educational and professional environment.

9. **Industry Implications**

The proposed AI-Based Fake Certificate Verification System Using QR Code helps industries verify employee qualifications quickly and securely. It reduces certificate fraud, saves time in recruitment, and supports better hiring decisions. The system can be integrated with existing HR platforms, improving operational efficiency and strengthening trust in digital credentials.

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10. Limitations & Scope for Future Research

The study's forgery-detection model was trained and tested on a limited dataset of certificates from a specific institutional context, which may limit general is ability to other certificate formats and languages. The system also assumes that issuing institutions maintain a secure and consistently updated verification database. Future research should test the framework across larger and more diverse certificate datasets, explore block chain-based decentralised alternatives to the central database, and evaluate user adoption and trust in real institutional deployments.

Conflicts of Interest Declaration

- The authors declare that there are no conflicts of interest regarding the publication of this research.

Informed Consent Declaration

- This study did not involve identifiable personal data beyond a certificate sample used for model testing; where applicable, all data were used solely for academic research purposes.

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