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(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

Department of Artificial Intelligence and Data Science

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Project Synopsis On

AI Based Student Certificate Authentication

Under The Guidance Of

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PROJECT GUIDE

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AI Based Student Certificate Authentication

INTRODUCTION

- **Introduction of Domain:**

In today's digital era, the field of **Educational Technology (EdTech)** has gained significant importance in transforming the way academic processes are managed. Educational institutions are rapidly adopting technology to enhance teaching, learning, evaluation, and administrative tasks. Within this domain, one of the major challenges faced by institutions is the management and verification of academic records such as certificates, achievements, and extracurricular credentials. Traditionally, these processes are carried out manually, which is not only time-consuming but also prone to errors, inconsistencies, and even fraudulent practices.

- **Domain Description:**

1)Problems:

In academic institutions, verifying and evaluating student or faculty certificates is often carried out manually. This process is not only time-consuming but also prone to human error and inconsistency. Different institutions follow different methods, which leads to a lack of standardization in awarding marks or credits for extracurricular activities, internships, and paper presentations. Moreover, the manual approach makes it difficult to maintain a centralized and secure record of all submissions, while also increasing the chances of duplicate or fraudulent certificates being accepted.

2) Solution:

To address these challenges, an automated web-based system can be developed to authenticate certificates and evaluate performance. The system uses OCR and metadata extraction techniques to verify details such as title, issuer, date, and type of certificate. Rule-based models are then applied to assign standardized scores based on parameters like certificate type, issuer reputation, and duration. The verified and scored certificates are stored in a centralized digital database, which can be accessed through dashboards by administrators and faculty. This automation not only reduces manual workload but also ensures accuracy, transparency, and fairness in the evaluation process.

3) Application:

The proposed system has a wide range of applications in academic environments. For students, it provides quick and transparent evaluation of achievements, which can be used for academic credits, placements, and further studies. For faculty and administrators, it simplifies certificate verification, reduces workload, and helps in performance tracking. Institutions benefit from a standardized and merit-based evaluation system that promotes fairness and credibility. Additionally, recruiters and placement teams can rely on the system for validated performance scores. In the future, the system can be extended to include blockchain or QR-based certificate authentication, resume evaluation, and automated notifications, making it a valuable solution for modern academic ecosystems.

RELATED WORK

1.Paper 1:

A decentralized and security-enhanced professional title evaluation system in universities under mobile Internet of Things

1.Summary of work:

The paper focuses on applying **blockchain technology in certificate issuance and verification systems**. It proposes a decentralized framework that ensures authenticity, transparency, and tamper-proof verification of academic and professional certificates. The system leverages blockchain's immutability and distributed ledger features to prevent forgery and fraudulent activities. Additionally, the framework aims to simplify the certificate verification process for educational institutions, organizations, and employers.

2. Limitations:

1. **Scalability Issues** – Blockchain networks face performance challenges when handling a large number of transactions, which may affect system adoption in large institutions.
2. **High Computational and Storage Costs** – Maintaining blockchain nodes and data storage is resource-intensive.
3. **Integration Challenges** – Adopting blockchain requires significant restructuring of existing certificate management systems.
4. **User Accessibility** – Not all institutions or employers are technologically ready to adopt blockchain infrastructure.
5. **Legal and Regulatory Concerns** – The system may face difficulties due to lack of global regulatory frameworks for blockchain-based certification.

2.Paper 2:

Lightweight public key infrastructure for the Internet of Things: A systematic literature review

1.How limitation of paper 1 tackled:

1. Paper 1 focused on blockchain for certificate issuance/verification but had **scalability, energy consumption, and integration issues**.

2. Paper 2 tackles this by proposing a **mobile IoT (M-IoT) and blockchain-based decentralized professional title evaluation system**. It uses **Hyperledger Fabric (permissioned blockchain)** instead of public blockchain, ensuring **faster transactions, reduced energy consumption, and better scalability**.
3. To handle large file storage issues, **IPFS (InterPlanetary File System)** is integrated instead of storing all data directly on blockchain, overcoming Paper 1's data bloat limitation.

2.Summary of Work:

The paper introduces a **blockchain and Mobile IoT-based digital professional title evaluation system** for universities. It leverages **Hyperledger Fabric** for decentralized data management, **IPFS** for secure document storage, and **smart contracts** for automated evaluation processes. The system ensures **transparency, fairness, and data security** while reducing manual intervention. Users can remotely apply and track their applications, while reviewers conduct multi-level auditing via blockchain consensus. Experimental results show good throughput and efficiency, proving its practical applicability.

3.Limitations:

1. **Hierarchical bottleneck** – Although decentralized, it still relies on the traditional multi-stage hierarchical evaluation process, so delays in one stage can block others.
2. **Scalability & resource consumption** – As the number of applicants and institutions grow, data storage and transaction processing load will increase.
3. **Energy consumption** – While improved compared to public blockchain, still higher than traditional centralized systems.
4. **Implementation cost** – Requires blockchain infrastructure, IoT integration, and expert training.

3.Paper 3:

A Faster, Integrated, and Trusted Certificate Authentication and Issuer Validation System Based on Blockchain

1.How to overcome limitations of paper 2:

Paper 2 focused on improving the transparency and security of online evaluation using blockchain, but it still had some drawbacks such as high resource consumption,

scalability concerns, and dependency on traditional review hierarchies. Paper 3 overcomes these issues by introducing optimized consensus mechanisms, lightweight smart contracts, and off-chain storage techniques. These improvements reduce computational load, increase processing efficiency, and minimize storage bottlenecks. Moreover, Paper 3 proposes better integration with IoT-enabled devices to streamline digital evaluation, making the system more adaptive and scalable.

2. Summary:

The paper presents a **blockchain-enabled certificate and evaluation verification system** that ensures transparency, authenticity, and tamper-proof management of academic/professional certifications. It emphasizes security enhancements such as **identity verification, consensus validation, and smart contract automation**, while also integrating external data storage for efficiency. The work highlights the use of distributed ledgers to eliminate fraud, improve fairness, and reduce administrative overhead in academic/organizational evaluations.

3.Scope for Modification:

1. **Energy efficiency**: Future research can adopt greener consensus protocols (e.g., Proof of Stake, BFT variations).
2. **AI integration**: Incorporating AI/ML can enhance fraud detection and automate evaluation processes further.
3. **Interoperability**: Enhancing cross-platform compatibility with other institutional systems.
4. **User-centric design**: More intuitive interfaces for applicants, reviewers, and institutions.

4.Implementation:

1. Deployment in **universities** for academic title evaluation.
2. Integration with **government portals** for issuing/verifying professional certifications.
3. Use in **corporate HR systems** for transparent hiring/promotion decisions.
4. Expansion to **international collaborations** ensuring standard, secure credential verification globally.

PROBLEM DESCRIPTION

In educational institutions, certificates are an essential part of showcasing student and faculty achievements beyond academics. These may include workshops, online courses, paper presentations, internships, and extracurricular activities. However, the process of verifying and evaluating these certificates is highly inefficient when handled manually. Administrators often spend considerable time cross-checking the authenticity of submitted certificates, which not only delays the evaluation process but also introduces a high risk of human error.

Another major issue is the **lack of standardization** in evaluation. Different institutions, departments, or faculty members may follow different criteria for awarding marks or credits, leading to inconsistencies and unfair recognition of student efforts. This inconsistency discourages students from participating in extracurricular or professional development activities, as their achievements may not be valued uniformly.

Moreover, **fraudulent or duplicate certificates** are becoming increasingly common. Without a robust verification system, institutions may unknowingly accept fake credentials, which undermines the credibility of both the student and the institution. Maintaining a secure and centralized record of certificates also becomes challenging, especially when dealing with large volumes of data across multiple students and academic years.

PROBLEM STATEMENT

Design and develop an **AI Based Student Certificate Authentication**.

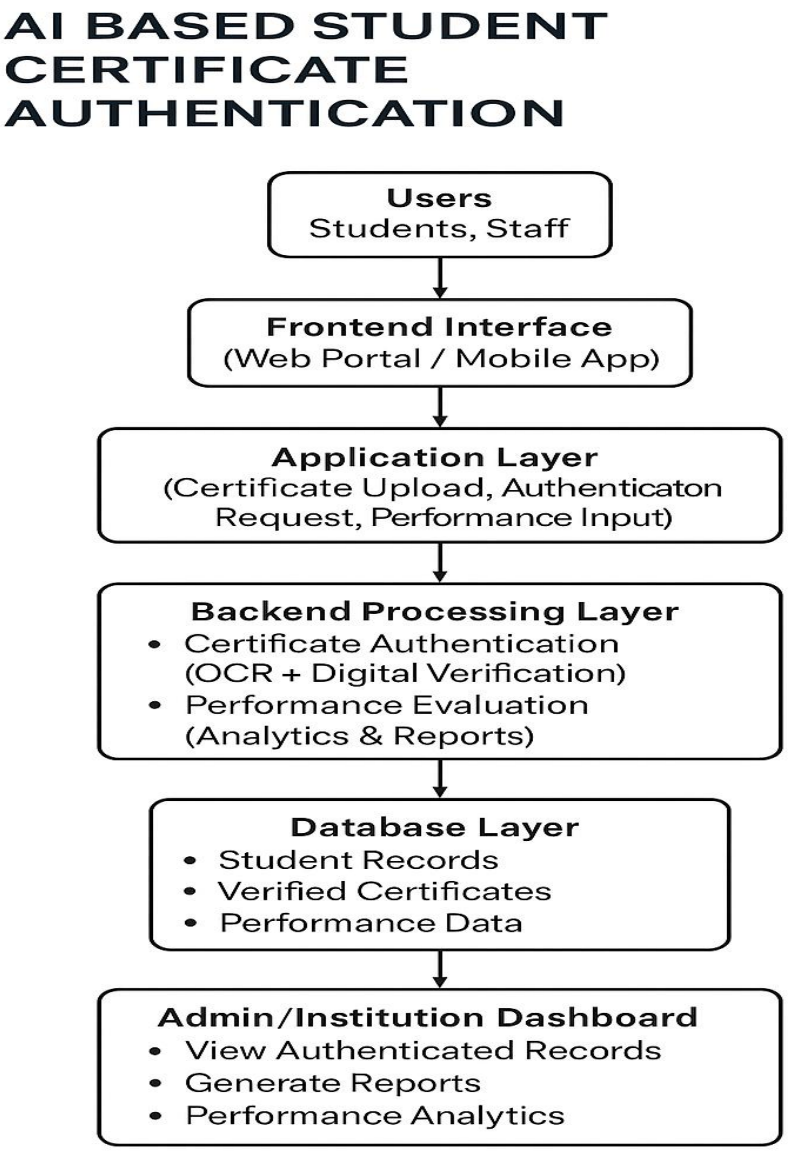
This system will automate the verification of certificates using metadata and rule-based analysis, assign standardized scores based on certificate type, issuer, and duration, and maintain a secure centralized database to ensure accuracy, transparency, and fairness in the evaluation process.

OBJECTIVES

1. To develop a web-based platform that enables students and faculty to submit and store academic certificates in a centralized system.
2. To implement an automated authentication and scoring mechanism using metadata extraction and predefined rule-based analysis.
3. To improve the accuracy, transparency, and efficiency of certificate verification and performance evaluation through automation.

METHODOLOGY

Architectural Diagram:



Description of each module:

1. User Interaction Module (Frontend + Application Layer)

- This module is responsible for communication between **users** (students, staff, faculty) and the system.
- It provides a **web portal or mobile app** interface where users can log in securely.
- Students can upload certificates, submit authentication requests, and input performance data.
- The application layer checks the validity of submissions (format, completeness) before sending them to the backend.
- Ensures a **user-friendly interface** and smooth data flow into the system.

2. Processing & Verification Module (Backend Layer)

- This is the **core module** where the main operations happen.
- Performs **certificate authentication** using OCR (Optical Character Recognition) and digital verification.
- Runs **performance evaluation algorithms** to analyze student data and generate reports.
- Uses **analytics and smart contracts (if blockchain is included)** to ensure tamper-proof, transparent verification.
- Provides secure, automated, and reliable evaluation with minimal human intervention.

3. Data Management & Reporting Module (Database + Admin Dashboard)

- Manages all **student records, verified certificates, and performance data** in a structured database.
- Provides the **Admin/Institution Dashboard** to view authenticated records, generate reports, and analyze performance trends.
- Ensures **data integrity, quick retrieval, and secure storage** for long-term institutional use.

FACILITIES REQUIRED

1.Personal Computer with Specifications

- Processor: Intel i5 or higher
- RAM: 8 GB (minimum)
- Storage: 500 GB HDD/SSD
- Operating System: Windows 10 / Linux / macOS

2.Application Development Tools

- Backend: Spring Boot / Node.js
- Frontend: HTML, CSS, JavaScript (React/Angular optional)
- Database: MySQL / PostgreSQL
- OCR & Text Extraction: Tesseract OCR, OpenCV, NLP libraries
- IDE/Tools: Eclipse, IntelliJ IDEA, or Visual Studio Code

3.Other Special Requirements

- Dataset of sample academic certificates for training and testing.
- Internet connectivity for external API integration (e.g., issuer verification).
- (Optional) Blockchain/QR Code APIs for certificate authenticity validation.

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