

A Next Gen Loan Prediction Model - Trustify

Anagha S¹, Ananthakrishnan S², Arjun M³, Akash N S⁴, Shinu Jacob⁵

¹Bachelor of Technology in CSE, NCERC

²Bachelor of Technology in CSE, NCERC

³Bachelor of Technology in CSE, NCERC

⁴Bachelor of Technology in CSE, NCERC

⁵Assistant Professor, Department of CSE, NCERC

Abstract - The rapid growth of digital banking has created a need for secure, efficient, and automated loan management systems. Traditional loan processing methods are time-consuming, error-prone, and lack transparency. This paper proposes an AI and Blockchain-based Smart Loan Management and Verification System that integrates Artificial Intelligence (AI), Blockchain technology, and automated document processing. The system enables secure storage of loan records using blockchain, ensuring immutability and tamper-proof verification. AI techniques are used for document summarization, financial analysis, and loan eligibility prediction. Additionally, deep learning models are incorporated to detect forged or manipulated documents such as deepfake images. The proposed system improves efficiency, enhances security, reduces manual intervention, and ensures transparency in loan processing. This approach provides a reliable and scalable solution for modern banking systems.

Key Words: Blockchain, Smart Loan, Artificial Intelligence, Document Verification, Deepfake Detection, Financial Analysis.

1.INTRODUCTION

Loan management is an important process in banking systems that includes loan application, document submission, verification, approval, and tracking. In traditional systems, loan processing is mostly manual, where users are required to submit physical documents and visit banks to apply for loans or check their status. This process takes more time, increases human effort, and may lead to errors and delays. Banks also face difficulties in verifying documents and predicting loan eligibility, while managing user complaints and tracking activities becomes complex. Due to the lack of automation, transparency is reduced and the overall efficiency of the system is affected.

To overcome these issues, the Smart Loan Management System is designed to automate and simplify the entire loan process for users, banks, and administrators. The system allows users to register, apply for loans, upload documents, and track their loan status. Banks can manage loan requests, verify applications, and predict loan eligibility, while administrators can monitor system activities, manage banks, and handle user complaints. This reduces manual work and improves communication between all entities involved in the system.

The system integrates Blockchain technology to ensure secure document storage and verification. Important loan details such as loan ID, user ID, bank ID, loan amount, and document hash are stored in the blockchain, making the records immutable and tamper-proof. Each uploaded document is converted into a SHA256 hash and stored in the blockchain. During verification, the system compares the stored hash with the newly generated

hash to check document authenticity. If the hashes match, the document is considered genuine; otherwise, it is detected as tampered. This approach ensures data integrity and provides a permanent audit trail for all loan transactions.

In addition to blockchain, the system uses Artificial Intelligence to enhance functionality. AI is used for document summarization, financial report generation, and loan eligibility analysis based on user income and expenses. The system can automatically generate monthly financial reports and assist banks in evaluating a user's repayment capacity. Furthermore, a deep learning-based detection system is used to identify fake or manipulated images such as deepfakes, face swaps, and AI-generated images. This improves the reliability of identity verification and prevents fraudulent activities.

By combining database efficiency with blockchain security and AI-based automation, the proposed system improves the speed, accuracy, and transparency of loan processing. It reduces paperwork, minimizes human errors, and provides a user-friendly platform for all stakeholders. This makes the system more efficient and suitable for modern digital banking environments.

2.LITERATURE REVIEW

In recent years, several systems have been developed to improve the efficiency of loan management processes by reducing manual effort and enhancing decision-making capabilities. Traditional loan processing systems rely heavily on manual operations, including physical document submission, verification, and approval procedures. These systems are time-consuming and prone to human errors, which affects the overall efficiency and transparency of banking operations. Additionally, users are required to frequently interact with bank officials for status updates, making the process inconvenient and less scalable.

To overcome these limitations, many existing systems have incorporated Artificial Intelligence (AI) techniques to automate loan-related processes. AI-based approaches are used for loan prediction, financial analysis, and document summarization. These systems analyze user data such as income and expenses to generate financial reports and evaluate loan eligibility. Furthermore, AI-based document summarization techniques help in extracting key information from uploaded documents, enabling faster verification by banks. Although these systems improve processing speed and reduce manual workload, they mainly rely on centralized databases, which may be vulnerable to data modification and security issues.

In order to enhance data security and ensure trust, Blockchain technology has been introduced in financial applications. Blockchain provides a decentralized and distributed ledger where data is stored across multiple nodes, eliminating the need for a central authority. One of the key advantages of blockchain

is its immutability, which ensures that once data is recorded, it cannot be altered. This feature is particularly useful in loan management systems for maintaining secure and tamper-proof records of loan transactions. Blockchain also improves transparency and traceability, allowing all participants to verify the authenticity of stored data.

Several systems have also focused on improving document integrity using cryptographic hashing techniques. In these approaches, documents are converted into unique hash values using algorithms such as SHA256. These hash values are stored securely and later used for verification by comparing them with newly generated hashes. If the values match, the document is considered authentic; otherwise, it is identified as tampered. While this method ensures document security, it is often implemented independently and not fully integrated with complete loan processing systems.

In addition to document verification, AI-based document processing techniques such as Optical Character Recognition (OCR) and PDF text extraction have been used to automate data extraction from uploaded files. These techniques allow the system to process both image-based and text-based documents efficiently. Extracted data is further analyzed to generate summaries and financial insights, reducing the need for manual document review. However, these systems may still face challenges when dealing with manipulated or forged inputs.

Recent research has also explored the use of deep learning models for detecting fraudulent or manipulated images. Techniques based on convolutional neural networks are used to identify deepfake images, face swaps, and AI-generated content. These systems classify images into categories such as real or fake based on probability scores. Additional detection mechanisms, including sketch detection and AI-generated image detection, further enhance the reliability of the system. Despite their effectiveness, these solutions are typically developed as standalone modules and are not fully integrated into loan management systems.

From the above analysis, it is evident that existing systems address individual aspects such as automation, security, or fraud detection. However, they lack a unified framework that combines all these functionalities into a single platform. Therefore, there is a need for an integrated system that combines AI for intelligent processing, Blockchain for secure and immutable data storage, and deep learning techniques for fraud detection. Such a system can significantly improve efficiency, enhance transparency, ensure data integrity, and provide a reliable solution for modern loan management.

3. Technology used in AI Interview Agent System

Software used:

HTML5:

HTML5 is used to design the structure of the web application. It provides the layout for pages such as user registration, login, loan application, and dashboard interfaces.

CSS3:

CSS3 is used to style and enhance the appearance of the web pages. It helps in creating a responsive and user-friendly interface.

JavaScript:

JavaScript is used to handle client-side functionality such as form validation, dynamic updates, and interaction between the user and the system.

Python:

Python is used as the main backend programming language. It

handles system logic, processes loan requests, integrates AI modules, and manages communication between database and blockchain.

MySQL:

MySQL is used as the database to store user details, loan information, income and expense data, complaints, and feedback. It ensures efficient data management.

Ethereum:

Ethereum is used as the blockchain platform to store secure and tamper-proof loan records. It provides decentralization and data immutability.

Solidity:

Solidity is used to develop smart contracts that store and manage loan data on the blockchain.

Ganache:

Ganache is used as a local blockchain environment for testing smart contracts and transactions safely without using real cryptocurrency.

Web3.py:

Web3.py is used to connect the Python backend with the Ethereum blockchain and interact with smart contracts.

PyPDF2:

PyPDF2 is used to extract text from PDF documents uploaded by users for processing and analysis.

pytesseract:

pytesseract is used for Optical Character Recognition (OCR) to extract text from image-based documents.

PyTorch:

PyTorch is used to implement deep learning models for detecting fake or manipulated images.

Transformer:

This library is used to load pretrained models for detecting AI-generated images and sketches.

PIL(PythonImagingLibrary):

PIL is used for image processing and conversion before analysis.

RegularExpression(re):

The re module is used for cleaning and formatting extracted text data.

PyCharm:

PyCharm is used as the development environment for writing and debugging Python code.

AndroidStudio:

Android Studio can be used for developing mobile application features if required.

4. Proposed System

Improvements Over the Existing System:

• AI-Based Loan Automation

The system automates loan application, verification, and approval processes using Artificial Intelligence, reducing manual effort and processing time.

• Blockchain-Based Secure Storage

Loan records and document hashes are stored in blockchain, ensuring immutability and preventing unauthorized modification of data.

• Dual Storage Mechanism

The system uses a database for normal operations and blockchain for secure storage of critical loan data, providing both efficiency and security.

• Document Integrity Verification

Each uploaded document is converted into a SHA256 hash. The system compares stored and generated hashes to detect any tampering.

• AI-Based Document Processing

The system extracts text from PDF and image documents using OCR and processes the data for summarization and analysis.

• Financial Analysis and Report Generation

The system generates financial reports based on user income and expenses, helping in better financial understanding and decision-making.

• Loan Eligibility Prediction

AI analyzes user financial data to evaluate repayment capability and predict loan eligibility.

• Deepfake and Fraud Detection

The system detects fake or manipulated images such as deepfakes, face swaps, and AI-generated images using deep learning models.

• Centralized Complaint Management

Users can send complaints and receive responses, improving communication and transparency.

• Improved Transparency and Trust

Blockchain ensures all loan records are transparent, traceable, and verifiable.

Unlike the existing systems, our system includes the following roles:

1. AdminModule:

Manages the overall system, including banks, users, complaints, and system monitoring.

2. BankModule:

Manages loan types, verifies loan requests, performs loan eligibility prediction, and handles user requests.

3. UserModule:

Allows users to register, apply for loans, upload documents, manage financial data, and track loan status.

Table -1: PERFORMANCE METRICS FOR AI-BASED LOAN EVALUATION SYSTEM

Method	Accuracy (%)	Precision (%)	Recall (%)	F1Score (%)
Traditional Loan Processing	72.5	70.2	68.9	69.5
Existing AI Loan Systems	85.3	83.7	82.4	83.0
Proposed Smart Loan System	93.6	91.8	92.5	92.1

Table -2 PERFORMANCE METRICS FOR DOCUMENT AND FRAUD VERIFICATION

Metric	Detection Rate (%)	Accuracy (%)	Response Time
Document Tampering Detection	97.2	96.5	2.1
Deepfake Image Detection	95.8	94.9	2.4 94.6
AI-Generated Image Detection	94.6	93.8	2.6
Hash Verification (Blockchain)	99.1	98.7	1.8

5.Challenges Faced During Implementation**Blockchain Integration**

Integrating blockchain with the Python backend required careful configuration and reliable communication with the Ethereum network.

Smart Contract Deployment

Developing and deploying smart contracts in Solidity involved handling transaction execution and contract functions correctly.

Document Hashing and Verification

Ensuring accurate SHA256 hash generation and comparison was critical to correctly detect document tampering.

Dual Storage Management

Maintaining consistency between database storage and blockchain records required proper synchronization.

AI-Based Document Processing

Extracting and analyzing text from PDFs and images was challenging due to varying document formats and quality.

Deepfake and Fraud Detection

Implementing deep learning models for detecting fake images required accurate classification and efficient resource management.

System Performance and Response Time

Managing blockchain operations and AI processing together increased system complexity and affected response time.

6. System Design**6.1. Architecture of the System**

6.2 Module Include

User Module

- Allows users to register and log in to the system.
- Enables users to apply for loans and upload required documents.
- Provides facility to track loan status and view reports.
- Allows users to submit complaints and feedback.

Bank Module

- Manages loan types and loan-related details.
- Verifies user documents and loan applications.
- Performs loan eligibility prediction using financial data.
- Approves or rejects loan requests.

Admin Module

- Manages users, banks, and system records.
- Monitors overall system activities and performance.
- Handles complaints and feedback from users.
- Ensures smooth functioning of the system

7. Implementation and Results

7.1 System Development

The Smart Loan Management and Verification System is developed as a web-based application by integrating Artificial Intelligence and Blockchain technologies to ensure secure and efficient loan processing.

Frontend Development

- The frontend of the system is developed using HTML, CSS, and JavaScript.
- It provides user interfaces for registration, login, loan application, and dashboards.
- The design ensures a user-friendly and interactive experience.

Backend Development

- The backend is developed using Python to handle system logic and processing.
- It manages user requests, loan processing, and integration with AI and blockchain modules.
- It acts as a bridge between frontend, database, and external services.

Database Development

- MySQL is used to store user details, loan data, financial records, and complaints.
- It ensures efficient storage, retrieval, and management of structured data.
- It supports fast access for regular system operations.

Blockchain Development

- Ethereum is used as the blockchain platform for secure data storage.
- Smart contracts are developed using Solidity to store loan details and document hashes.
- Ganache is used for testing blockchain transactions in a local environment.
- Web3.py is used to connect the backend with the blockchain.

AI Integration

- AI is used for document processing, summarization, and financial analysis.
- OCR and PDF processing tools extract data from uploaded documents.
- The system generates reports and predicts loan eligibility based on financial data.

Fraud Detection System

- Deep learning models are used to detect fake or manipulated images.
- The system identifies deepfakes, face swaps, and AI-generated images.
- This improves the accuracy and reliability of document verification.

System Integration

- All modules such as frontend, backend, database, AI, and blockchain are integrated into a single system.
- The system ensures smooth communication between users, banks, and administrators.
- Proper integration improves system performance and reliability.

7.2 System Testing

System testing is performed to ensure that the Smart Loan Management and Verification System works correctly, securely, and efficiently.

Functional Testing

- Verifies core functionalities such as registration, loan application, and document upload.
- Ensures correct workflow from loan submission to approval or rejection.

Blockchain Testing

- Verifies secure storage of document hashes and loan details in the blockchain.
- Ensures correct SHA256 hash generation and comparison for document verification.

AI Module Testing

- Tests document processing using OCR and PDF extraction methods.
- Validates loan eligibility prediction and financial analysis accuracy.

Fraud Detection Testing

- Verifies detection of fake and manipulated images using deep learning models.
- Ensures accurate classification of real and fake images.

Performance Testing

- Evaluates system response time during loan processing and verification.
- Ensures efficient handling of multiple user requests.

Security Testing

- Ensures secure handling of sensitive user and financial data.
- Verifies protection against unauthorized access and data tampering.

Results:

The system responded effectively during loan processing and verification, where AI-based document analysis and loan eligibility prediction were performed accurately, blockchain-based hashing ensured secure document verification, and fraud detection along with loan approval decisions were generated as expected.

7.3 Results :



Fig 7.1: login page

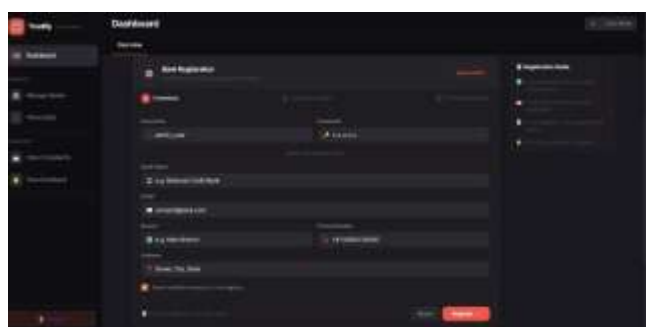


Fig 7.2: bank registration



Fig 7.3: Loan registration

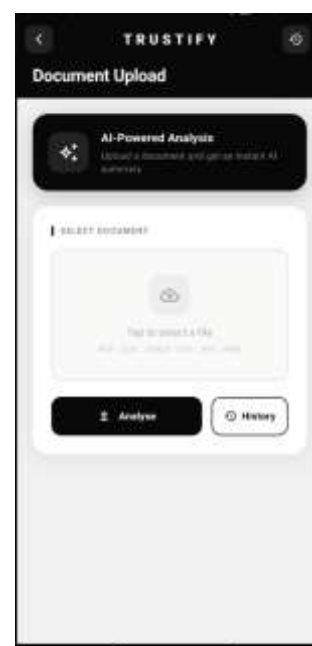


Fig 7.4: Report generation



Fig 7.3: Bank side loan and report prediction

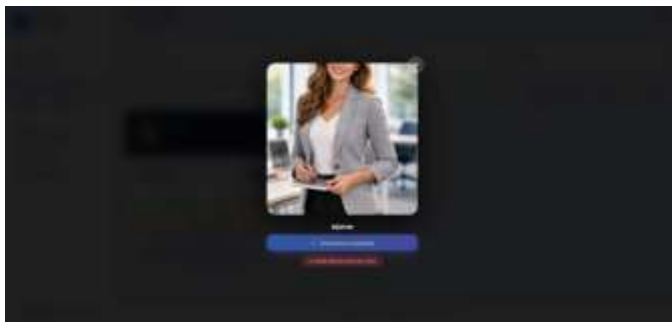


Fig 7.4: Payment Page

8. DISCUSSION AND ANALYSIS

8.1 Advantages of Smart Loan System

Automated Loan Processing

The system automates loan application, document verification, and approval, reducing manual effort and processing time.

Secure and Tamper-Proof Data Storage

Blockchain technology ensures that loan data and document hashes are securely stored and cannot be modified.

AI-Based Loan Evaluation

AI techniques analyze user financial data to predict loan eligibility accurately and efficiently.

Efficient Document Processing

OCR and PDF processing enable automatic extraction and analysis of data from uploaded documents.

Fraud Detection Mechanism

The system detects fake or manipulated documents using deep learning models, improving system reliability.

Improved Transparency and Tracking

Users can track loan status, and all transactions are transparent and verifiable through blockchain.

8.2 Future Work

Integration of advanced AI models to improve loan prediction accuracy and financial analysis. Enhancement of fraud detection techniques for better identification of manipulated documents. Development of a mobile application to improve accessibility and user experience. Deployment on cloud platforms to support large-scale users and real-time processing. Improvement of user interface for better usability and interaction.

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10. CONCLUSION

The proposed Smart Loan Management and Verification System provides an intelligent and efficient solution for modern loan processing. The system automates the loan process by integrating Artificial Intelligence, Blockchain technology, and document processing within a web-based platform. By improving efficiency, transparency, and security, the system simplifies loan application, verification, and approval procedures. The AI-driven modules analyze financial data, generate reports, and predict loan eligibility, ensuring accurate and consistent decision-making.

The system also enhances security through blockchain-based storage and SHA256 hashing, which ensures tamper-proof verification of documents. Fraud detection mechanisms using deep learning further strengthen the system by identifying manipulated or fake documents. Through its role-based access, the system improves coordination between users, banks, and administrators while maintaining organized records and transaction history. This enables faster loan processing and more reliable verification.

Overall, the Smart Loan System demonstrates the potential of combining AI and Blockchain technologies to transform traditional loan management into a more automated, secure, and transparent process. The system provides financial institutions with a reliable platform for efficient and scalable loan management in modern digital environments.

REFERENCES

1. S. Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," 2008.
2. V. Buterin, "A Next-Generation Smart Contract and Decentralized Application Platform," Ethereum White Paper, 2014.
3. I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*, MIT Press, 2016.
4. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, Pearson, 2010.
5. R. Smith, "An Overview of the Tesseract OCR Engine," *Proceedings of ICDAR*, 2007.

6. A. Vaswani et al., "Attention Is All You Need," *Advances in Neural Information Processing Systems*, 2017.
7. K. He et al., "Deep Residual Learning for Image Recognition," *IEEE CVPR*, 2016.
8. T. Mikolov et al., "Efficient Estimation of Word Representations in Vector Space," 2013.
9. D. Chaum, "Blind Signatures for Untraceable Payments," *Advances in Cryptology*, 1983.
10. J. Benet, "IPFS – Content Addressed, Versioned, P2P File System," 2014.
11. P. Mell and T. Grance, "The NIST Definition of Cloud Computing," NIST, 2011.
12. M. Abadi et al., "TensorFlow: Large-Scale Machine Learning on Heterogeneous Systems," 2016.
13. Y. LeCun, Y. Bengio, and G. Hinton, "Deep Learning," *Nature*, 2015.
14. A. Krizhevsky, I. Sutskever, and G. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," 2012.
15. T. Chen and C. Guestrin, "XGBoost: A Scalable Tree Boosting System," 2016.
16. J. Dean and S. Ghemawat, "MapReduce: Simplified Data Processing on Large Clusters," 2008.
17. M. Swan, *Blockchain: Blueprint for a New Economy*, O'Reilly, 2015.
18. N. Kshetri, "Blockchain's Roles in Strengthening Cybersecurity," *Computer*, IEEE, 2017.
19. A. Dorri, S. Kanhere, and R. Jurdak, "Blockchain in Internet of Things: Challenges and Solutions," IEEE, 2017.
20. R. Jain and S. Sharma, "AI-Based Loan Prediction System Using Machine Learning Techniques," *International Journal of Computer Applications*, 2020.