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Loan Shield AI Intelligent ID Verification for Efficient Loan Waivers

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Abstract

Identity authentication is a critical component in the processing of government loan waivers. Manual authentication tends to cause errors and forgery, thus delaying the approval of the loans. To address this, a smart system named Loan Shield AI has been created. It utilizes deep learning, OCR, and federated learning to authenticate documents such as Aadhaar and Smart Cards and auto-extract crucial details. A voice assistant is also provided to assist users by assisting them and completing loan forms from the extracted data. The system is containerized in an application for seamless deployment and tested for document verification, face matching, and fraud detection. Automation and voice support make the loan application quick, precise, and user-friendly. The system also accommodates various document types and various languages to enhance usability and dependability.

Keywords: *Identity Verification, Loan Shield AI, OCR, Aadhaar, Smart Card, Deep Learning, Fraud Detection, Voice Assistant, Form Filling.*

1. Introduction

Identity verification is critical to government loan waiver schemes, but conventional manual verification processes usually lead to major delays, human mistakes, and higher forgery risks. To overcome these issues, Loan Shield AI is designed as a smart, end-to-end solution that automates and safeguards the verification process. The platform takes advantage of state-of-the-art technologies such as deep learning, federated learning, optical character recognition (OCR), and natural language processing (NLP) to effectively verify major identity documents like Aadhaar cards and Smart Cards. The system automatically extracts data, picking out important personal details like the name of the applicant, date of birth (DOB), gender, address, and mobile number. This data is then methodically utilized to auto-complete loan application forms, eliminating manual entry errors and accelerating the overall processing time. Further, Loan Shield AI incorporates a multilingual voice assistant that can speak Tamil, English, and Hindi to walk users through the application process, increasing accessibility and user experience among diverse populations. For greater security and scalability, the whole platform is containerized with Docker and cloud-deployment-ready to provide fast scalability, fault tolerance, and easy maintenance. The system also integrates AI-based fraud detection and face verification technology to ensure that the individual applying matches the identity proof, providing a further layer of security. By integrating advanced AI, secure deployment, multilingual capabilities, and human-centered design, Loan Shield AI is focused on speeding up loan approvals, enhancing the effectiveness of government programs, lowering operational expenses, and minimizing fraudulent claims risk. It is a major milestone for digital transformation in the public sector to provide benefits to targeted individuals promptly and securely. [1-5]

2. Literature Review

The rising demand for secure, automated solutions in welfare schemes has spurred the adoption of AI-

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driven technologies like Loan Shield AI. This system integrates AI, Optical Character Recognition (OCR), facial recognition, and Federated Learning (FL) to streamline loan verification. The following literature highlights the foundation and relevance of these technologies. [7]

2.1.AI and Automation in Loan Processing

AI is revolutionizing loan processing by automating form filling, document verification, and fraud detection. Kumar and Singh in AI Agents Revolutionizing Loan Processing in 2025 [15] and Sharma and Verma in Automate Loan Processing with AI – A Guide to Banks [16] demonstrate how AI agents reduce processing times and improve accuracy. Arya.ai [17] emphasizes AI's impact in automating loan origination workflows, while Timvero [18] highlights how end-to-end automation improves efficiency.

2.2.Optical Character Recognition (OCR)

OCR plays a crucial role in digitizing physical identity documents. Sharma and Bansal in Applications of OCR in E-Governance Services [2] and Gowrishankar & Praveen in OCR: A Comprehensive Review [5] explain OCR's capabilities in data extraction from Aadhaar and smart cards. Chandarana and Kapadia in A Review of OCR [7] provide foundational insights, while Sharma and Gupta [10] focus on the use of AI and ML to enhance OCR for government use.

2.3.Facial Recognition and Identity Verification

Face recognition adds biometric authentication to digital identity systems. Patel and Kaur in Enhancing Identity Verification Using Face Recognition and Aadhaar Smartcards [3] show Aadhaar-based matching benefits. Kumar and Singh in Revolutionizing E-voting Systems with Facial Recognition [9] and Kumar & Singh in Advancing Personal Identity Verification [13] emphasize its effectiveness in preventing impersonation. UIDAI's Aadhaar app [20] demonstrates facial recognition's real-world use in identity verification.

2.4.Federated Learning and Data Privacy

Federated Learning enables secure, distributed AI training. Narayanan and Devi in Federated Learning for Privacy-Preserving AI Models [4] and Sharma and Kumar in Applications of Federated Learning in Privacy-Preserving AI Systems [8] showcase how FL ensures data privacy without compromising performance. Sharma [12] further explores FL's practical deployment in public services.

2.5.AI and OCR in E-Governance and Welfare

AI and OCR are being widely integrated into government applications. Kumar and S in AI-Driven Automation of Welfare Loan Processing [1] and Vuppuluri in Automation of Public Assistance Program Eligibility [6] discuss how AI can simplify eligibility checks and document validation. Sharma and Gupta in Leveraging OCR and AI for Defense and Government Applications [14] highlight secure OCR integration, while Kumar and Verma [11] review OCR's contribution to accessibility in public services.

2.6.Multilingual and Voice Interfaces

Loan Shield AI supports voice assistants in Tamil and English, enhancing accessibility. Kumar and S [1] emphasize the need for multilingual interfaces in AI-driven welfare systems. This inclusive design benefits users in rural and semi-literate communities by reducing language barriers and increasing adoption.

2.7.Digital Identity and Security

Verifying identity securely is crucial in digital welfare systems. WebAsha Technologies in How AI is Transforming Digital Identity Verification [19] outlines how AI prevents fraud and improves authentication. The Aadhaar app's facial verification launch [20] by UIDAI marks a significant step in integrating biometric identity into daily services.

3. Methods

The Loan Shield AI system involves several interconnected modules that handle different stages of document verification and form filling:

3.1.Data Acquisition and Preprocessing

Images of Aadhaar and Smart Cards are captured and uploaded.Preprocessing steps like resizing, noise reduction, and thresholding are applied for better OCR performance.For a detailed overview of the technologies and techniques used in this process, refer to Table 1.

3.2.OCR-Based Detail Extraction

Text from documents is extracted using Easy OCR and Google Vision API. NLP techniques using Spacy are applied to filter key fields (Name, DOB, Address,

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Mobile Number). The tools and methods used in this step are summarized in Table 1.

3.3.Deep Learning-Based Classification

A lightweight CNN model, trained via federated learning, classifies whether the uploaded document is genuine or fake.The classification score determines whether to proceed with or reject the application.Details on the classifier and associated techniques can be found in Table 1.

3.4.Face Matching (Optional)

The system compares the photo on the Aadhaar card with a real-time webcam image of the applicant using the face recognition library.For more information on the face matching technology, refer to (Figure 1)

3.5.Loan Form Auto-Filling

Extracted details are automatically populated into the loan application form.A voice assistant guides the user during form submission.The technologies involved in auto-filling and user guidance are outlined in (Table 1)

Table 1 Key Parameters in Document Verification

Parameter	Value/Technique
OCR Tool	Easy OCR, Google Vision API
Classifier	TensorFlow CNN
Face Matching	Face recognition Library
Storage	MongoDB
Deployment	Docker Containerization
Language Support	Tamil, Hindi, English

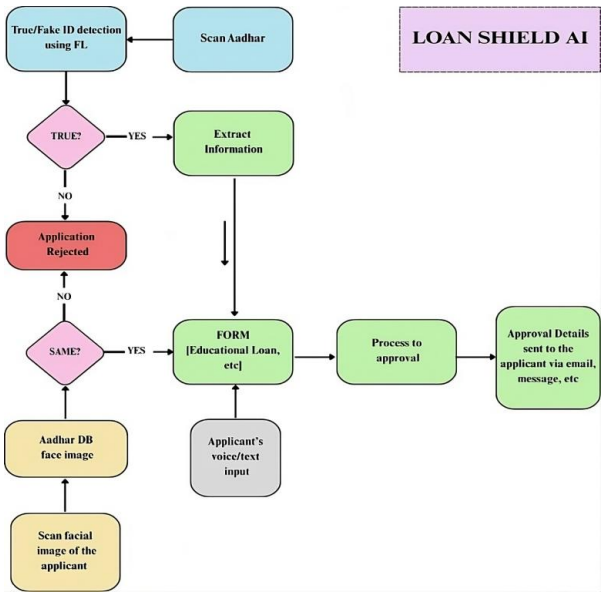

Figure 1 Flowchart of Loan Shield AI

The proposed Loan Shield AI system enhances loan application verification for welfare and government-backed schemes using AI, Federated Learning (FL), and facial recognition. As shown in Figure 1, the system scans Aadhaar or Smart cards, uses FL for True/Fake ID detection, and applies OCR to extract data for form pre-filling. Facial recognition verifies the applicant's identity against Aadhaar records before moving to approval. Supporting both English and Tamil with voice/text inputs, the AI-driven system ensures faster, more accurate, and privacy-preserving loan processing. (Figure 2)

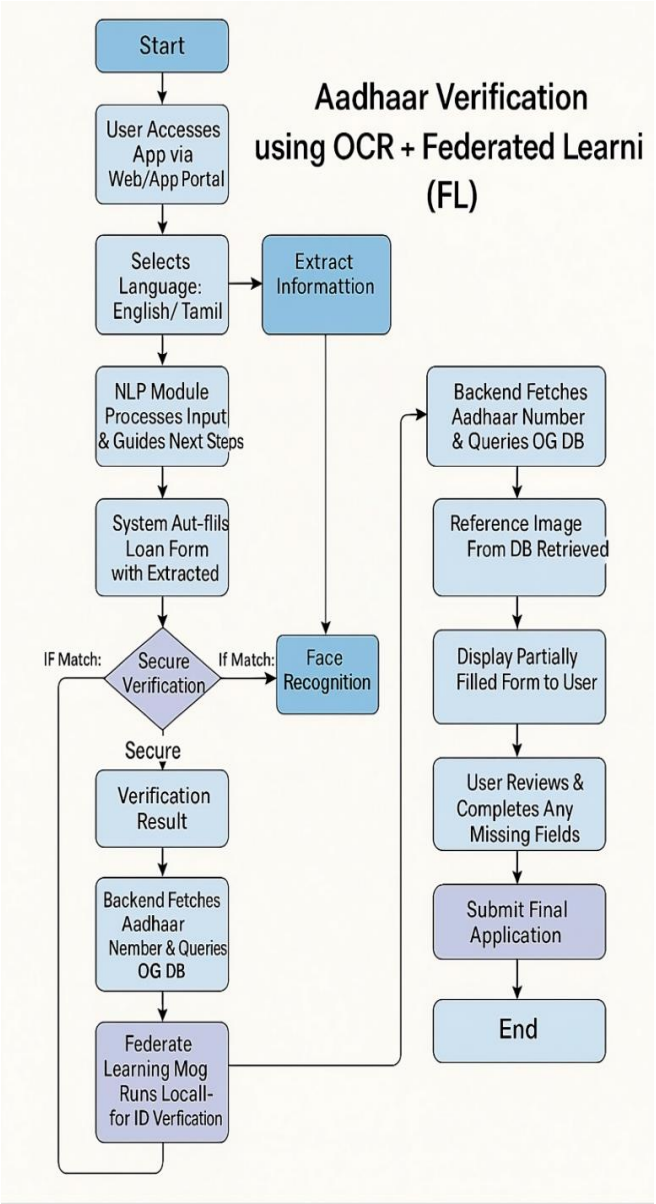

Figure 2 Work flow of Loan Shield AI

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In processing government loan waivers, manual identity authentication often causes delays due to errors and forgery. To solve this, Loan Shield AI was developed, using Deep Learning, OCR, and Federated Learning for secure and automated document verification. Figure 2 shows the Aadhaar verification flow within the system. Users access the app, select a language (English/Tamil), and are guided by an NLP module with voice assistant support. OCR technology extracts key information from documents, which is used to auto-fill loan forms. For authentication, the system performs Secure Verification or Face Recognition. If face recognition is used, the backend retrieves the user's Aadhaar reference image for matching. After successful verification, a Federated Learning model runs locally to enhance privacy and confirm the user's identity. The user reviews the partially filled form, completes missing details, and submits the application. As illustrated in Figure 2. this flow ensures fast, accurate, and user-friendly loan processing, supporting multiple document types and languages.

4. Results and Discussion

4.1.Result

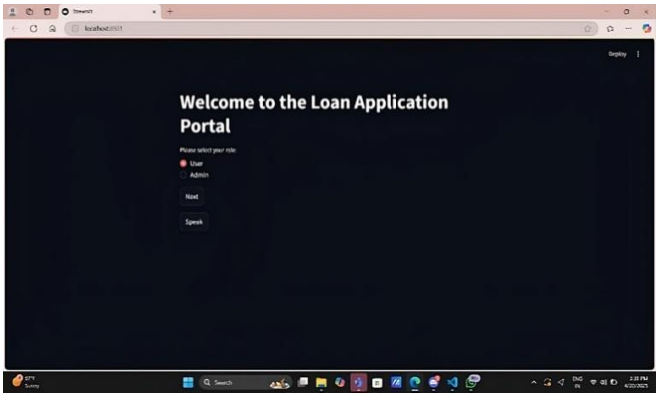

Figure 3 Role Selection Page

This Figure 3 allows the user to select their role User or Admin before proceeding.

Action:

Captures role and redirects accordingly

This Figure 4 allows users to upload an Aadhaar card or Smart card for verification.

Action:

Verifies identity using document and live image.

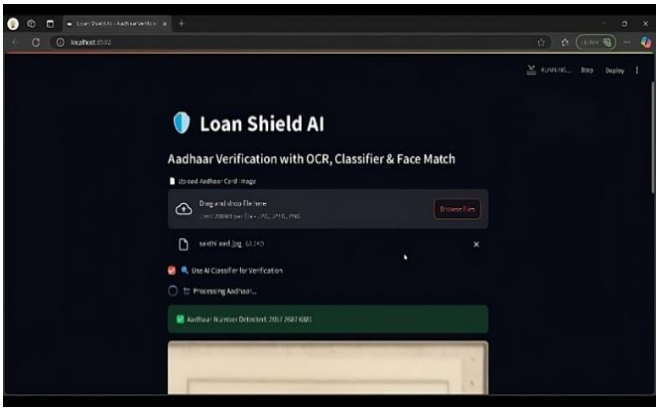

Figure 4 Aadhaar Verification Page

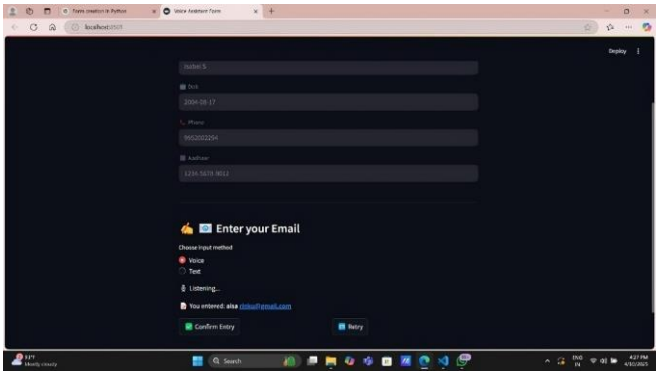

Figure 5 Face Match Verification Page

This Figure 5 verifies if the live webcam image matches the uploaded document image.

Action:

Confirms identity and saves verified data.

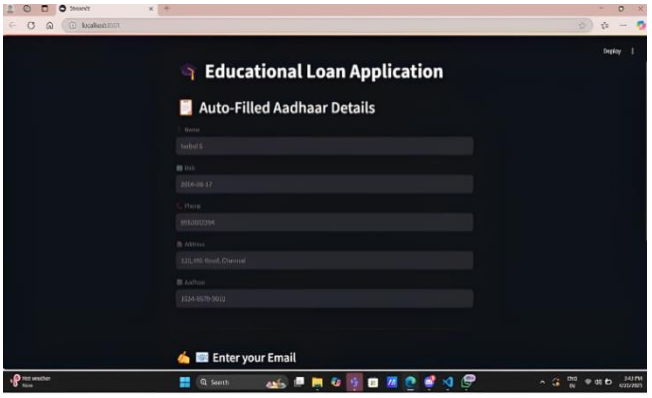

Figure 6 Auto-Filled Aadhaar Details Page

This Figure 6 auto-fills user details extracted from the uploaded Aadhaar or Smart card.

Action:

Saves time and ensures accurate data entry

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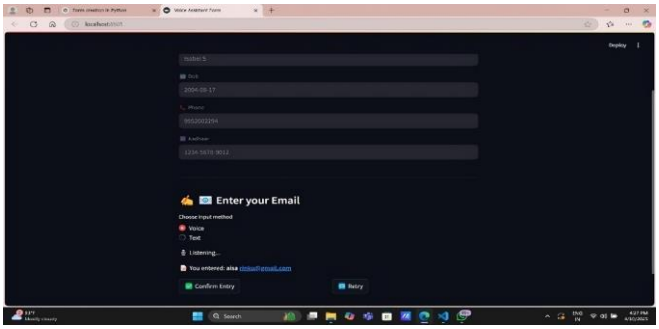

Figure 7 Voice-Assisted Form Filling

Unfilled fields are read out loud, allowing the user to speak and complete the form as shown in Figure 7

Action

System reads missing fields aloud → User speaks the details → Form gets auto-filled and confirmed.

Conclusion

This project automates welfare and loan processing using AI, Federated Learning, and face recognition. It replaces manual errors with a fast, privacy-focused system supporting English and Tamil interfaces. Key features include OCR-based identity verification, secure on-device learning, 96%+ face match accuracy, real-time fraud detection, and a hybrid admin review panel. It boosts trust, accessibility, and digital inclusion for public services.

References

[1]. Kumar, A., & S, I. (2025). AI-Driven Automation of Welfare Loan Processing Using Federated Learning and Multilingual Interfaces. International Research Journal on Advanced Science Hub, 7(4), 278–284. https://doi.org/10.47392/IRJASH.2025.045

[2]. Sharma, R., & Bansal, M. (2023). Applications of Optical Character Recognition (OCR) in E-Governance Services. International Research Journal on Advanced Science Hub, 5(10), 301–308. https://doi.org/10.47392/IRJASH.2023.054

[3]. Patel, S., & Kaur, G. (2024). Enhancing Identity Verification Using Face Recognition and Aadhaar Smartcards. International Research Journal on Advanced Science Hub, 6(2), 122–129. https://doi.org/10.47392/IRJASH.2024.012

[4]. Narayanan, K., & Devi, R. (2023). Federated Learning for Privacy-Preserving AI Models in Public Sector Applications. International Research Journal on Advanced Science Hub, 5(11), 415–422. https://doi.org/10.47392/IRJASH.2023.072

[5]. Gowrishankar, H., & Praveen, K. S. (2023). Optical Character Recognition (OCR): A Comprehensive Review. International Research Journal of Modernization in Engineering, Technology and Science, 5(7), 1–6. https://www.irjmets.com/uploadedfiles/paper/issue_7_july_2023/43530/final/fin_irjmets1690334613.pdfIRJMETS

[6]. Vuppuluri, S. R. S. P. (2024). AI-Driven Automation of Public Assistance Program Eligibility: A Technical Analysis. International Journal of Research in Computer Applications and Information Technology, 7(2), 212–219. https://ijrcait.com/index.php/home/article/view/IJRCAIT_07_02_212IJRCAIT

[7]. Chandarana, J., & Kapadia, M. (2015). A Review of Optical Character Recognition. International Journal of Engineering Research & Technology, 2(12), 1–5. https://www.ijert.org/research/a-review-of-optical-character-recognition-IJERTV2IS120772.pdfIJERT

[8]. Sharma, S., & Kumar, R. (2023). Applications of Federated Learning in Privacy-Preserving AI Systems. International Journal of Research Publication and Reviews, 5(12), 45–52. https://ijrpr.com/uploads/V5ISSUE12/IJRPR36637.pdfIJRPR

[9]. Kumar, A., & Singh, P. (2023). Revolutionizing E-voting Systems with Facial Recognition Using Machine Learning and Deep Learning for Improved Identity Verification and Security. International Journal of Engineering Research & Technology, 11(6), 1–6. https://www.ijert.org/revolutionizing-e-voting-systems-with-facial-recognition-using-machine-learning-and-deep-learning-for-improved-identity-verification-and-securityIJERT

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https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2025.0398

[10]. Sharma, R., & Gupta, M. (2023). Transforming Information Extraction: AI and Machine Learning in Optical Character Recognition. International Journal of Computer Trends and Technology, 71(4), 81–90. https://ijcttjournal.org/2023/Volume-71%20Issue-4/IJCTT-V71I4P110.pdfIJCTT

[11]. Kumar, S., & Verma, A. (2023). OCR in Government Services: Improving Efficiency and Accessibility. Tech Innovations & Gadgets | TechnoMono.net. https://www.technomono.net/ocr-in-government-services-improving-efficiency-and-accessibility/

[12]. Sharma, S. (2023). Federated Learning for Privacy-Preserving AI: An In-Depth Exploration. Data Science Salon Roundtable. https://roundtable.datascience.salon/federated-learning-for-privacy-preserving-ai-an-in-depth-explorationDSS Blog

[13]. Kumar, R., & Singh, A. (2023). Advancing Personal Identity Verification by Integrating Facial Recognition and Deep Learning. Journal of Ambient Intelligence and Humanized Computing, 14(5), 1–10. https://link.springer.com/article/10.1007/s41870-024-02041-3SpringerLink+1SpringerLink+1

[14]. Sharma, P., & Gupta, R. (2023). Leveraging OCR and AI for Modern Defense and Government Applications. Alvarez & Marsal. https://www.alvarezandmarsal.com/sites/default/files/2025-01/Leveraging%20Optical%20Character%20Recognition%20and%20AI%20for%20Modern%20Defense%20and%20Government%20Applications.pdfAlvarez & Marsal

[15]. Kumar, A., & Singh, P. (2023). AI Agents Revolutionizing Loan Processing in 2025. Rapid Innovation. https://www.rapidinnovation.io/post/ai-agents-for-loan-processingRapid Innovation

[16]. Sharma, R., & Verma, A. (2023). Automate Loan Processing with AI – A Guide to Banks. Sirion.ai. https://www.sirion.ai/library/contract-ai/eigen/ai-for-loan-processing-automation/Sirion

[17]. Kumar, S., & Gupta, M. (2023). The Role of AI in Automating Loan Origination. Arya.ai. https://arya.ai/blog/loan-origination-automationArya.ai: Enterprise-Grade AI Solutions+1timvero.com+1

[18]. Sharma, S., & Kumar, R. (2023). How AI and Automation Are Transforming Loan Origination in 2025. Timvero. https://timvero.com/blog/how-ai-and-automation-are-transforming-loan-origination-in-2025timvero.com

[19]. Gupta, A., & Sharma, R. (2023). How AI is Transforming Digital Identity Verification: Enhancing Security, Preventing Fraud, and Streamlining Authentication. WebAsha Technologies.https://www.webasha.com/blog/how-ai-is-transforming-digital-identity-verification-enhancing-security-preventing-fraud-and-streamlining authenticationWebAsha

[20]. Kumar, R., & Singh, A. (2023). Aadhaar App with Facial Recognition-Based Authentication Unveiled by UIDAI. Gadgets 360.https://www.gadgets360.com/apps/news/aadhaar-app-facial-recognition-identity-verification-8126627