Digital Onboarding Revolution: A Unified E-KYC Approach

Jagdish Pimple; Kushal Khadgi; Kalyani Pahadia; Nakul Wanjari

St. Vincent Pallotti College of Engineering & Technology/ Information Technology, Nagpur, India

Abstract

The banking industry is rapidly evolving to adopt secure and efficient methods that enhance client onboarding experiences. This project introduces a Unified Know Your Customer (KYC) Verification System aimed at automating and streamlining the account opening process for banks. Traditionally reliant on manual data entry, which is susceptible to delays and errors, KYC procedures are now reimagined using cutting-edge technologies. The proposed system integrates national-level APIs to authenticate key identity documents such as Aadhaar, PAN, and driving licenses. Additionally, it employs Azure Cognitive Services for Optical Character Recognition (OCR) to extract and validate data from submitted documents against official records. Upon successful cross-verification, the system generates a unique identifier (UID) for each client, enabling secure, reusable digital identities for future banking operations. This not only simplifies client access to multiple services but also enhances data integrity and regulatory compliance. The methodology ensures reduced manual workload, faster onboarding, and increased accuracy in identity verification processes. Results demonstrate improved operational efficiency and stronger adherence to Anti-Money Laundering (AML) standards. In conclusion, the Unified KYC Verification System offers a scalable, secure, and user-centric solution that transforms traditional banking processes while aligning with digital transformation goals in the financial sector.

Keywords:

Unified KYC Verification, Optical Character Recognition (OCR), National APIs, Unique identifier (UID), AML Compliance.

1.Introduction

In today's competitive, digital-first banking environment, efficient client onboarding is critical todeliveringaseamlesscustomerexperienceandmaintainingregulatory compliance. Traditional onboarding methods, which involve manual identity verification and repetitive data entry, are not only time- consuming and error-prone but also increase operational costs. These outdated processes often lead to delays, customer dissatisfaction, and challenges in maintaining data accuracy. To address these limitations, this research proposes a Unified KYC Verification System that transforms the onboarding journey through automation and digital integration. The proposed system leverages national APIs such as Aadhaar, PAN, and others to perform real-time document authentication, eliminating the need for manual checks. It incorporates Azure Cognitive Services' OCR technology to extract data directly from submitted identity documents, ensuring both speed and accuracy in information capture. Once verification is complete, a unique identifier (UID) is generated for each client, which acts as a secure digital identity for all future banking transactions. This not only streamlines client interactions but also enforces strict compliance with Anti- Money Laundering (AML) regulations. By minimizing human intervention, the system significantly reduces the chances of fraud and errors, enhances operational efficiency, and delivers a user-friendly, transparent onboarding experience tailored to the expectations of modern banking clients.

2.Literature Survey

The literature on personalized learning and recommendation systems has advanced with the development of algorithms and platforms that tailor educational experiences to individual learners' needs and preferences. This review highlights various methodologies and frameworks used to adapt content and learning paths, optimizing educational outcomes. [1] A web-based KYC system tackles issues in the financial sector by digitizing and automating procedures, helping to prevent illegal activities such as money laundering.

DOI: https://doi.org/10.5281/zenodo.18144929

[2] It highlights its advantages of immutability and transparency, which safeguard data integrity. [3] The banking industry is advancing by incorporating machine learning, 5G, and blockchain technologies to improve security, streamline processes, and strengthen identity verification in KYC procedures. [4] It examines the potential of blockchain for providing secure, decentralized KYC verification, improving data privacy and ensuring compliance with regulations.[5] The system utilizes mobile network addresses for KYC verification, connecting user data to a mobile node and validating it by cross-referencing with telecom data via an ISP interface. [6] It combines IPFS and blockchain to securely store
and exchange KYC documents, removing the need for repeated verifications across different banks. [7] The paper introduces the Universal Authentication and Authorization Framework (UAAF), a user-centric, privacy-by-design, and decentralized system that enables individuals to possess a reliable digital identity composed of multi- purpose and multi-origin attributes. In the context of online banking, UAAF facilitates the enforcement of Know Your Customer (KYC) regulations by allowing users to combine verifiable identity attributes issued by different organizations. This approach streamlines the process of opening a new bank account online while ensuring compliance with KYC requirements. [8] The paper "A Security and Privacy Focused KYC Data Sharing Platform" proposes a solution for secure and efficient sharing of Know Your Customer (KYC) data among banks using blockchain technology and privacy-enhancing techniques. It addresses the challenges faced by banks in complying with strict KYC regulations while minimizing redundancy and costs. The proposed platform ensures that banks retain control over their customers' data by using encrypted internal storage, and data sharing occurs only with customer consent. [9] The paper titled "KYC Optimization Using Distributed Ledger Technology" by José Parra Moyano and Omri Ross focuses on improving the Know Your Customer (KYC) process using Distributed Ledger Technology (DLT). KYC verification is conducted only once for each customer and the verified data is then recorded on a distributed ledger, which is accessible by all financial institutions involved in the customer's financial activities.[10] The paper concludes that a blockchain-based e-KYC platform offers a secure, efficient, and user-friendly alternative to traditional KYC processes, addressing key challenges while ensuring compliance with regulatory standards. [11] The paper concludes that integrating blockchain technology into the e- KYC process can significantly enhance efficiency, reduce redundancy, improve compliance, and elevate customer service, making it a promising solution for modern banking challenges.[12] The paper "Enhancing e-KYC Security and Privacy: Harnessing Quantum Computing and Blockchain in Web 3.0" presents advocates for a revolutionary approach to e-KYC that harnesses cutting-edge technologies to overcome existing challenges, ultimately leading to a more secure and efficient system.[13] The paper titled "Banking Security and Customer Experience: Cloud Computing-Enabled KYC in the Digital Era using ANN Model" presents several important conclusions regarding the integration of IoT and ANN models in the banking sector, particularly in the context of Know Your Customer (KYC) processes.[14] The paper highlights the transformative potential of AI in banking compliance, particularly in relation to KYC principles, and underscores the need for a strategic approach to integrate human and technological resources effectively.[15] The paper presents a compelling case for the implementation of a decentralized e-KYC (Electronic Know Your Customer) system in Bangladesh, addressing the pressing need for a unified solution to identity verification. It highlights the growing prevalence of fraud and scams in the digital age, underscoring the importance of a robust identity verification mechanism to mitigate these risks. The proposed blockchain-based system offers a significant advantage by allowing users to complete their KYC verification just once, which can then be utilized across multiple organizations, thereby eliminating the need for repetitive verification processes.[16] The paper underscores the transformative potential of blockchain technology in enhancing KYC processes within the framework of CBDCs, while also addressing regulatory and societal considerations that are essential for successful implementation.[17] The paper presents a privacy-preserving e-KYC (electronic Know Your Customer) system that utilizes blockchain technology to enhance security and efficiency in identity verification processes. This system addresses the growing need for secure digital identification in the financial sector, particularly as more services move online [18] The paper titled "Know Your Customer Verification using Blockchain and CPABE Algorithm" presents a thorough exploration of the proposed e KYC Trust Block system, leading to the integration of blockchain

DOI: https://doi.org/10.5281/zenodo.18144929

technology with Ciphertext- Policy Attribute-Based Encryption (CP-ABE) establishes a robust security framework for KYC verification. [19] The paper highlights the growing need for privacy in identity verification processes, particularly in Thailand, where e-KYC face authentication is widely used. The authors emphasize that facial images are sensitive personal data protected under the Personal Data Protection Act (PDPA). [20] This paper explores the impact of session recording and document auto-capture on KYC compliance. It indicates these technologies can streamline the KYC process, reducing time, effort, and costs for financial institutions. However, it gives potential drawbacks and areas for further research such as Fraud and Spoofing Risks and different jurisdictions varying data protection laws, making compliance complex.

3.Problem Statement

Conventional KYC methods have long relied on manual processes and paper documentation, which often results in significant delays and errors. These outdated methods require a substantial amount of time and effort to complete, making the entire onboarding and verification process inefficient. In response to these challenges, e-KYC systems have been introduced to automate the verification process, aiming to streamline and accelerate the KYC procedure. However, even with e- KYC, some manual review is still required, which diminishes the system's overall efficiency and prolongs processing times. As a result, while e-KYC systems are more efficient than traditional methods, they are not fully automated and still necessitate human oversight for verification accuracy. This ongoing reliance on human intervention not only affects operational efficiency but can also create frustration for both customers and bank employees. For customers, the process can feel cumbersome and time-consuming, and for employees, the manual tasks detract from their ability to focus on higher-value activities that could enhance customer service and business outcomes. By increasing automation within e-KYC systems, it would be possible to further reduce the need for manual intervention, thereby improving operational efficiency, speeding up the verification process, and freeing up employees to focus on tasks that provide greater value, such as personalized customer interactions and decision-making. This greater level of automation would not only enhance customer satisfaction but also improve the overall effectiveness and scalability of the system, benefiting both financial institutions and their clients.

4.Proposed Approach

The proposed Unified KYC Verification System is engineered to strengthen security measures while ensuring strict adherence to Anti- Money Laundering (AML) regulations. By automating traditionally manual verification processes, the system enables financial institutions to detect and flag suspicious activities with greater efficiency and consistency. Through real-time data validation and the use of advanced algorithms, the system enhances the precision and reliability of KYC checks, making the verification process not only faster but also significantly more secure. This proactive approach not only reduces the risk of fraud but also supports regulatory bodies in enforcing compliance standards effectively. In terms of functionality, the system distinguishes itself through a streamlined, user-friendly interface that enhances the overall onboarding experience. Clients can easily upload required documents, which are then processed using Optical Character Recognition (OCR) and cross-verified against government databases such as Aadhaar, PAN, DL, and Voter ID APIs. By reducing manual data entry, the system minimizes human error and accelerates onboarding. This intuitive design also enables users from various backgrounds, including those with limited digital literacy, to complete the KYC process with ease, fostering greater accessibility and inclusivity. A standout feature of the platform is its transparency. Clients receive real- time updates on the status of their verification, ensuring that they remain informed and engaged throughout the entire process. This not only builds trust in the system but also enhances customer satisfaction by reducing uncertainty and providing a clear understanding of each step. Such transparency empowers users, fosters accountability, and sets a new benchmark in client onboarding for financial institutions. The unique identifier (UID) generated after successful verification plays a vital role in securing and managing client identities. This UID serves as a reusable digital identity, streamlining future banking interactions without the need for repeated document submissions. It also enhances data traceability and retrieval, providing banks with a reliable mechanism for managing client records while maintaining privacy and regulatory standards. The UID-based system can also be integrated with additional banking services and products, promoting seamless digital transformation across the institution. The unique identifier (UID) generated after successful verification plays a vital role in securing and managing client identities.

DOI: https://doi.org/10.5281/zenodo.18144929

This UID serves as a reusable digital identity, streamlining future banking interactions without the need for repeated document submissions. It also enhances data traceability and retrieval, providing banks with a reliable mechanism for managing client records while maintaining privacy and regulatory standards. The UID-based system can also be integrated with additional banking services and products, promoting seamless digital transformation across the institution.

5.Methodology

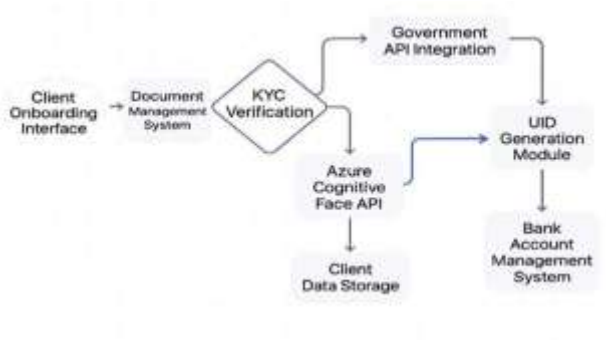

Fig.1. Integrated KYC and Client Onboarding Workflow

The diagram illustrates the architecture of the proposed Unified Know Your Customer (KYC) Verification System, designed to streamline and secure the client onboarding process for banking services. At the forefront is the Client Onboarding Interface, which acts as the primary access point for users to enter personal details and upload necessary identity documents. These inputs are funnelled into the Document Management System, which classifies, organizes, and queues the documents for further verification processes. The backbone of the system is the KYC Verification Module, which coordinates multiple authentication mechanisms to validate client information. This includes Government API Integration for document authentication via Aadhaar, PAN, Driver's License (DL), and Voter ID APIs. In parallel, Azure Cognitive Face API is employed to perform
facial recognition verification, ensuring that the user's submitted photo matches the image on official government records. Following successful verification, the UID Generation Module creates a Unique Identifier (UID) for each client, serving as a digital identity that can be reused for future banking interactions.

This UID is then linked to the Bank Account Management System, facilitating seamless account creation and integration of client data. All processed information, including document validation results and client metadata, is stored in a secure Client Data Storage system, ensuring data integrity and confidentiality. Additionally, the modular design allows for future scalability, enabling the system to support new APIs, third-party tools, or evolving compliance regulations. This end-to-end architecture not only accelerates the onboarding process but also enhances user trust, operational efficiency, and regulatory alignment in modern banking environments.

6.Expected Outcome

A streamlined client onboarding process enhances efficiency by automating KYC verification and integrating with government APIs for real-time data validation. Unlike traditional methods that rely heavily on paperwork and manual checks—resulting in delays, inconsistencies, and higher chances of error—automation ensures speed, accuracy, and regulatory compliance. By using secure digital channels, clients can submit identification documents remotely, while the system performs real-time cross-verification with official databases. Additionally, technologies such as the Azure Cognitive Face API introduce biometric authentication, verifying the client's identity through facial recognition and significantly reducing the risk of identity fraud. This digital transformation allows users to complete onboarding independently and securely, eliminating the need for physical visits to the bank. Beyond verification, the system assigns a unique key or identifier to each client upon successful onboarding
This unique ID simplifies future interactions by serving as a digital identity for all banking services. It enhances data management, retrieval, and auditability while ensuring access control and confidentiality of sensitive information. Financial institutions can use this identifier to quickly access a client's verified profile for additional services, reducing redundant verifications and improving customer experience. Furthermore, the system's centralized and secure storage infrastructure
ensures that all data remains tamper-proof and compliant with data protection regulations. Overall, this automated onboarding framework promotes a faster, safer, and more user-centric experience for both clients and organizations.

DOI: https://doi.org/10.5281/zenodo.18144929

7.Refrences

[1] Kazzaz, Z., "Emergency Disbursements During COVID-19: Regulatory Tools for Rapid Account Opening and Oversight," SSRN, vol. 3656651, July 20, 2020. SSRN, vol. 3656651, July 20, 2020.

[2] Niraj, R., Saujanya, P., Rudresh, P., Soumi, B., and Ramrao, A., "Optimizing the KYC process using a blockchain- based approach," Institute of Technology, Department of Information Technology, Navi Mumbai, India, vol. 44, pp. 03039, 2022. DOI: 10.1051/itmconf/20224403039.

[3] Sachin, P., Hari Prasad, J., and Latha Thamma, R., "Digital identity verification: Transforming KYC processes in banking through advanced technology and enhanced security measures," International Research Journal of Modern Engineering, Technology, and Science, vol. 5, pp. 25825208, 2023

[4] Huzaifa, J., Disha, D., and Prathima, M., "KYC Verification Using Blockchain Approach," International Journal for Research in Applied Science & Engineering Technology (IJRASET), vol. 11, June 2023.

[5] Lin, C.-Y., Chang, C.-H., and Chiu, H.-C., "Mobile network address-based verification system and method thereof," Research on cellular networks and mobile devices, 2020.

[6] Abdullah, M., Sheikh, H., Salahuddin, B., Kaiser, M., and Mohammad, Y., "Secure and Transparent KYC for Banking System Using IPFS and Blockchain Technology," Jahangirnagar University, pp. 348-351, June 2020.

[7] Romain, L., Arnaud, O., Samer, W. A., and François, B., "Know Your Customer: Opening a New Bank Account Online Using UAAF," in IEEE 17th Annual Consumer Communications & Networking Conference (CCNC), pp. 2331-9852, DOI: 10.1109/CCNC46108.2020.9045148, January 2020.

[8] Robert, N., Cyril, C., Wazen, S., Jean, H., Andrea, C., and Radu, S., "A Security and Privacy-Focused KYC Data Sharing Platform," in Proceedings of the 2nd ACM International Symposium on Blockchain and Secure Critical Infrastructure (BSCI '20), DOI: 10.1145/3384943.3409431, October 6, 2020, Taipei, Taiwan. ACM, New York, NY, USA.

[9] Parra, M., Department of Business Administration, University of Zurich, Moussonstrasse 15, 8044 Zurich, Switzerland, and Ross, O., Department of Computer Science, University of Copenhagen, Universitetsparken 5, 2100 Copenhagen, Denmark,

[10] "KYC Optimization Using Distributed Ledger Technology," Vol. 59, pp. 411-423, December 8, 2017.

[11] Cost-efficient Blockchain-based e-KYC Platform using Biometric verification (Bhatia, S., Vishwakarma, L., & Das, D. (2024). Cost- efficient Blockchain-based e-KYC Platform using Biometric verification

[12] Blockchain-Based Implementation on Electronic Know Your Customer (e-KYC)(Higashio, A. (2023). Blockchain- Based Implementation on Electronic Know Your Customer (e-KYC)

[13] Enhancing e-KYC Security and Privacy: Harnessing Quantum Computing and Blockchain in Web 3.0(Ahmed, G. M. F., Hasan, I., Hassan, M. S., Khan, R., Gefari, A. J. A., Buksh, Z., Liu, J. K., & Ali, A. B. M. S. (2024). Enhancing e-KYC Security and Privacy: Harnessing Quantum Computing and Blockchain in Web 3.0

[14] Banking Security and Customer Experience: Cloud Computing- Enabled KYC in the Digital Era using ANN Model(Nithya, A., Sangeethalakshmi, K., Muthukumaran, D., Sagunthala, R. Dr., Rd, R., Mahalakshmi, R., Naarayanasamy, M., & Srinivasan, C. (2024). Banking Security and Customer Experience: Cloud Computing- Enabled KYC in the Digital Era using ANN Model. 1,

[15] KYC Principles Embedded in AI-enabled Mobile Banking in the Face of Money-Laundering(Eid, J. B., Khachan, L., & Bonnet, M. (2022). KYC Principles Embedded in AI-enabled Mobile Banking in the Face of Money-Laundering. Proceedings - Academy of Management, 2022(1).

[16] Decentralized e-KYC System for Secure Identity Verification in Bangladesh(Karmoker, S., Khan, M. A., Chowdhury Anik, N. A., Hossain, M. S., Rahman, H., Rumpa, U. K., & Hasan, M. (2024). Decentralized e-KYC System for Secure Identity Verification in Bangladesh. 1–6

[17] Blockchain-Powered KYC in a CBDC World: The E-Rupee Experience(Dumbre, T., Sanadhya, S., Vijayakumari, L., Shaji, R., & Vinoth Kumar, C. N. S. (2024). Blockchain-Powered KYC in a CBDC World: The E-Rupee Experience. 389– 396

[18] Oneill, N. E. (2022). Enabling Trust and Privacy-Preserving e- KYC System Using Blockchain. IEEE Access, 10, 49028–49039

DOI: https://doi.org/10.5281/zenodo.18144929

[19] . Know Your Customer Verification using Blockchain and CPABE Algorithm(Mandava, S., Pereira, J. S., & Janagiraman, S. (2023). Know Your Customer Verification using Blockchain and CPABE Algorithm. [19] e-KYC-based Privacy Preserving Model using Smart Contract on Private Blockchain Network(Manoritthiyarn, W., Srisa-An, C., & Boonkhum, V. (2024). e-KYC-based Privacy Preserving Model using Smart Contract on Private Blockchain Network. 25–28.

[20] Enhancing KYC Efficiency and Accuracy Through Session Recording and Document Auto-Capture(Jayapal, C., Kumar R.B, H., Samuel.C, K., & A, J. (2023). Enhancing KYC Efficiency and Accuracy Through Session Recording and Document Auto- Capture. 1–7.

DOI: https://doi.org/10.5281/zenodo.18144929