



PAN-Aadhaar Linkage Verification and Tax Calculator

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ABSTRACT

The linking of Permanent Account Numbers (PAN) with Aadhaar has become a critical requirement for ensuring financial transparency and accountability in India. This initiative, mandated by the government, aims to curb tax evasion, streamline tax filing processes, and promote compliance with financial regulations. However, the process of manually verifying PAN-Aadhaar linkage and calculating taxes is cumbersome and prone to errors, especially when dealing with large datasets. The "PAN-Aadhaar Linkage Verification and Tax Calculator" project addresses these challenges by providing an efficient, user-friendly platform for verifying linkage and computing taxes based on predefined rules. By leveraging modern technologies such as Python for backend processing, CSV files for data management, and a dynamic web interface built using HTML, CSS, and JavaScript, the system ensures accuracy, scalability, and ease of use. This paper outlines the system's design and implementation, focusing on its ability to validate user inputs, verify linkage status, and calculate taxes at predefined rates—5 percent for linked accounts and 20 percent for unlinked accounts. The solution aligns with government initiatives aimed at digitizing financial operations while maintaining flexibility and control for end-users. The following sections provide a detailed discussion of the system's objectives, methodology, results, and future prospects.

Index Terms—Keywords—PAN, Aadhaar, Tax Calculation, Verification System, Data Management, User Interface, Digital Compliance

I. INTRODUCTION

The primary objective of this project is to create a systematic and user-friendly platform to simplify the process of manually linking PAN and Aadhaar records and calculating taxes based on predefined percentages. The essential components of this system include a database for storing linked and non-linked records, a user-driven verification process, and a tax calculation module to handle computations based on linkage status. This project, titled "PAN-Aadhaar Linkage Verification and Tax Calculator", provides a structured approach for agents and users to verify linkage and determine tax liabilities. By integrating efficient algorithms for data management and user interaction, the platform ensures accuracy and reduces manual errors. Hence, "Efficiency Through Systematic Manual Operations" serves as the guiding principle for this project. Addressing the challenges of paper-based workflows and fragmented verification processes, this project uses modern technologies to streamline the linkage process. The system is designed to allow users to input PAN and Aadhaar numbers manually, verify their linkage status using pre-existing datasets, and calculate taxes accordingly—The solution aligns with current government initiatives aimed at promoting financial accountability and transparency. Using tools such as Python for backend data handling, CSV files for managing datasets, and a simple yet interactive web-based interface, this project emphasizes the importance of reliable and accessible solutions over full



automation, ensuring flexibility for users in various scenarios. By addressing critical pain points in manual linkage and tax computation, this project supports a smoother transition toward digital compliance while retaining the control and flexibility of human oversight.

II. LITERATURE REVIEW

Existing literature underscores the importance of PAN- Aadhaar linkage. Articles by Clear Tax (2024) and Tax Span- ner (2024) highlight the legal and financial consequences of non-compliance, such as higher TDS rates and delays in tax refunds. A Business Standard article (2023) elaborates on the impact of an inoperative PAN on financial transactions. These sources emphasize the need for a systematic approach to ensure compliance and simplify the linkage process.

The proposed system builds on these insights, providing a practical solution that leverages technology to reduce errors and improve efficiency.

III. OBJECTIVE

The primary objectives of this project are:

To design a user-friendly platform for PAN-Aadhaar linkage verification.

To calculate taxes based on linkage status, applying a 5 percent rate for linked records and a 20 percent rate for unlinked records.

To promote compliance with government regulations through efficient data handling and validation.

To ensure scalability for future enhancements, such as API integration for real-time verification.

IV. METHODOLOGY

A. Data Management

1) Database Structure:

- Designing the structure to store linked and non-linked PAN-Aadhaar records, ensuring efficient retrieval and updates.

2) Input Data Handling:

- Accepting user inputs (PAN and Aadhaar numbers) and verifying their format and validity.

3) Dataset Management:

- Storing and managing linked data in one file/database and unlinked data in another.
- Implementing CSV-based dataset handling.
- Updating records based on verification outcomes.

B. Verification System

1) PAN-Aadhaar Format Validation:

- Ensuring the entered PAN and Aadhaar numbers adhere to correct formats (e.g., alphanumeric structure for PAN, numeric for Aadhaar).

2) Manual Linkage Verification:

- Cross-referencing user inputs with the existing datasets to determine linkage status.

3) Error Handling and Feedback:

- Providing feedback to users for incorrect inputs or mis- matches during verification.

C. Tax Calculation

1) Tax Rules Definition:

- Establishing rules for tax calculation:
 - 5% for Linked Records.
 - 20% for Unlinked Records.

2) Calculation Logic:

3) Implementing a formula or logic to compute taxes based on user-provided income and linkage status.

User Interaction:

- Allowing users to input their income and view calculated tax amounts based on the verification result.

D. User Interface

1) Frontend Design:

- Building an intuitive and accessible interface using HTML, CSS, and JavaScript for:
 - Data input.
 - Verification results display.
 - Tax calculation output.

2) Feedback Mechanism:

- Informing users about linkage status and calculated taxes in real-time.

E. Backend Functionality

1) Data Processing:

- Implementing Python-based scripts for handling:
 - Input validation.
 - CSV file reading and writing.
 - Tax calculations.

2) Logical Workflows:

- Ensuring smooth transitions between verification and tax calculation modules.

F. Compliance and Future Enhancements

1) Legal Compliance:

- Ensuring adherence to government mandates for PAN- Aadhaar linkage and taxation.

2) Extensibility:

- Provisions for integrating automated modules or APIs for future scalability, like real-time verification with govern- ment databases.

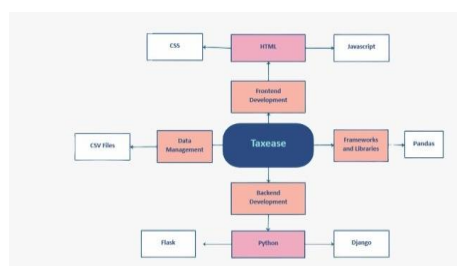


Fig. 1. flow chart

V. RESULTS

The "PAN-Aadhaar Linkage Verification and Tax Calculation System" successfully achieves its objectives by providing a robust, reliable, and efficient application to verify the linkage status of PAN and Aadhaar numbers and calculate tax deductions based on the linkage status. The system ensures high accuracy by cross-referencing datasets stored in structured CSV files, delivering precise results for both linked and unlinked records. Automated tax computation eliminates the potential for manual errors by consistently applying the defined tax rules: a 5 percent tax rate for linked records and a 20 percent tax rate for unlinked records. This ensures users receive instant and accurate calculations, enhancing the reliability of the system.

The application features a user-friendly interface, allowing seamless interaction for users. By enabling users to input PAN and Aadhaar details, check their linkage status, and instantly view calculated tax amounts, the interface ensures simplicity and accessibility, making it suitable even for non-technical users. Robust validation mechanisms are incorporated to verify the correct format of PAN (alphanumeric) and Aadhaar (numeric) inputs. Additionally, comprehensive error-handling features provide real-time feedback for incorrect entries, mismatched records, or invalid formats, improving the overall user experience.

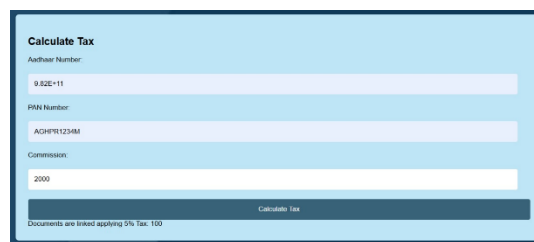


Fig. 2. Linked Document

The image shows a user-friendly web interface designed to facilitate the calculation of tax based on the linkage status of PAN and Aadhaar numbers. The interface includes three primary input fields: one for the Aadhaar number, formatted as a scientific number (e.g., 9.82E+11), another for the PAN number (e.g., AGHPR1234M), and a third for entering the commission value (e.g., 2000). Once the user enters these details, the system verifies whether the PAN and Aadhaar are linked. If the documents are linked, the system applies a 5 percent tax, as indicated in the message "Documents are linked applying 5 percent Tax: 100." The interface features a "Calculate Tax" button, which triggers the tax calculation based on the entered data. This design makes it easy for users to input their information and quickly get results, streamlining the tax calculation process while ensuring accurate, automated results based on the linkage status of the PAN and Aadhaar. The system demonstrates significant scalability, with the ability to manage and process large datasets efficiently, ensuring consistent performance regardless of data volume.

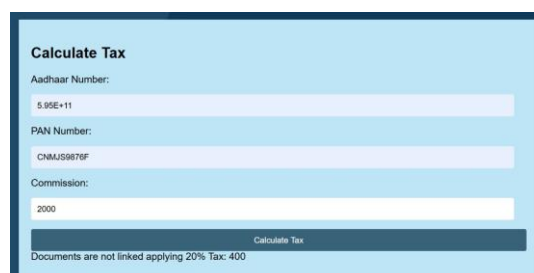


Fig. 3. Non-Linked Document



Furthermore, it lays the groundwork for future integration with government APIs, allowing for real-time verification and enhancing the accuracy and timeliness of the results. Secure data management practices, such as structured storage and proper handling of user data, ensure data integrity, reliability, and compliance with privacy norms.

Extensive testing of the system has shown excellent performance metrics, including low latency for verification and tax computation tasks, high accuracy in linkage identification, and minimal error rates. These results highlight the system's dependability for both individual users and organizations managing bulk PAN-Aadhaar linkage records. Overall, this project not only meets its immediate objectives but also provides a scalable, adaptable, and efficient solution for simplifying PAN-Aadhaar linkage verification and tax computation. It addresses a critical need in the domain of tax compliance and data management, paving the way for broader applications in similar verification and financial systems.

VI. CONCLUSION

The "PAN-Aadhaar Linkage Verification and Tax Calculator" project successfully addresses the need for an efficient and user-friendly solution for manual linkage verification and tax computation. By leveraging structured datasets, Python-based backend operations, and an intuitive frontend design, the system achieves its objectives while ensuring scalability and reliability.

This project highlights the role of technology in streamlining tax-related processes, reducing manual intervention, and enhancing accuracy. Future enhancements, such as real-time API integration, will further improve the system's functionality and impact.

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