

An Algorithmic Approach for Eliminating the Inconsistency of Linking Aadhaar Cards with Pan Cards of Indian Citizens

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Abstract: In India, the Aadhaar cards and PAN (Permanent Account Number) are very important and mandatory for Indian citizens. It is mandate to link both the cards in all official purposes. In most cases the present system exhibits discrepancy while linking, as the order of full names of individuals and positioning of initials are in a dissimilar pattern even if it's a genuine case. So a small percentage of individuals face difficulties and deny deserved official advantages. In most cases there exists a name mismatch problem in linking PAN with Aadhaar card of individuals. This work proposes a concise methodology for linking both these official documents to authenticate a person in related official records. We apply a precise algorithmic approach for linking these through government online portal (eg: E-Filing) by matching certain fields. In this work we exploit string searching & matching algorithm.

Index Terms: MaN Algorithm, SaI Algorithm, Fuzzy string matching algorithm, Knuth-Morris-Pratt (KMP) pattern searching algorithm, Dynamic Edit Distance algorithm, Rabin-Karp algorithm.

I. INTRODUCTION

In 2009, the UPA (United Progressive Alliance) government launched the Aadhaar project under the UIDAI (Unique Identification Authority of India). Aadhaar card includes demographic characteristics such as citizens' name, father / mother's name, date of birth, sex, citizen's address and biometric characteristics such as photography, fingerprints and iris (eye) details. The demographic features and the Quick Response (QR) code together with a unique 12-digit identity number called Aadhaar are printed on each citizen's card. All biometric and demographic data are stored in a centralized database. India's government has linked the Aadhaar card to various government schemes, such as gas cooking subsidies, household allocations, school scholarships, admission to remote and welfare homes,

passports, e-lockers (e.g. Digilocker), archiving documents, bank accounts under PMJDY (Pradhan Mantri Jan Dhan Yojana), provident funds, pensions, driving licenses, insurance policies, exclusions from mortgage and many more. In recent times, ATM Cash deal, Train bookings and application of the PAN (Permanent Account Number) card and the filing of income tax returns have also been made compulsory. PAN is the Permanent Account Number. It is an alphanumeric number of 10 characters that is unique to the PAN cardholder. It helps to identify the PAN cardholder or the taxpayer. PAN cards are required if a taxable salary or a taxable professional fee is received, a bank account is opened, assets are purchased or sold above the limit specified, etc. PAN cards serve as an identification issued by the government that is handy everywhere you go. Aadhaar is required to file income tax returns, so you have to link it to your PAN number. It will also help curb black money from the government.

II. EXISTING SYSTEM

A. Working

The most common complaint was by far a misrepresentation of the spelling of the name on the two documents and the only way to resolve it seemed to initiate a correction of one of them. In order to link the documents, one must go to www.incometaxindiaefiling.gov.in and left-hand click the tab "Link Aadhaar." You don't have to login or register on the website. Fill in your PAN and Aadhaar number, enter and submit your name as specified in Aadhaar. The link is confirmed once the details have been verified by the Indian Unique Identification Authority (UIDAI). If you are already registered on the e-filing site, after logging in, you can also link your Aadhaar. Just click the Link option for Aadhaar in the profile settings. The details are pre-populated, as per PAN, and you just have to enter your Aadhaar number and name exactly as mentioned in Aadhaar.

B. Issues

According to the website (www.incometaxindiaefiling.gov.in) the existing system face issue in linking Aadhaar with Pan. For the link to take place, it is important that both Aadhaar and PAN databases have the same name, sex and date of birth. Aadhaar was made compulsory to be linked to the PAN card, since then several cases of missing names on the PAN card and the Aadhaar card have been reported as well.

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III. PROPOSED SYSTEM

We are proposing an algorithm for searching and matching an individual’s Aadhaar card with PAN card where the data can be taken from the Aadhaar and Pan databases. For searching and matching we use two algorithms “**SaI Algorithm** (Searching an Individual)” and “**MaN Algorithm** (Matching a Name)” and also fetch five fields such as (Pin code, House no, Name, DOB, Mobile no) from both databases. In **SaI Algorithm**, we search using pin code and house no fields which helps in identifying the individual more efficiently and quickly. In **MaN Algorithm**, we match a person’s aadhaar and pan card using the Name, DOB and Mobile no fields. If all the five fields got matched successfully, the individual can link their cards or the authority can decide whether their cards should be linked or not.

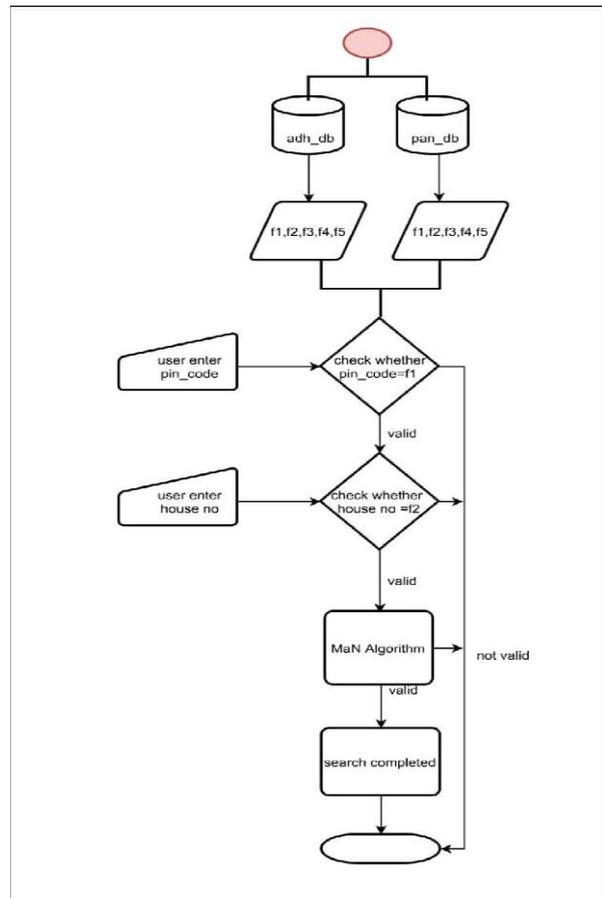
I. Fig: Aadhaar and Pan database.

Field	adh_db	pan_db
f1	pincode	pin code/Zip_code
f2	House No/ Bldg./Apt	Flat / Room / Door / Block No.
f3	full_name	First_name,middle_name, last_name
f4	Date_of_Birth	Date_of_Birth
f5	Mobile_no	Mobile_no

A. SaI Algorithm

- Step1: Start
- Step 2: Open aadhaar database adh_db, pan database pan_db and fetch the fields f1, f2, f3, f4 and f5
 - 2.1: Initialize a variable count = 0
- Step 3: Read pin_code value
 - 3.1: Assign pin = pin_code
 - 3.1.1: (adh_db(f1) = pin || pan_db(f1) = pin)
 - 3.1.2: Read House/Flat/Room/Door/Block Number
 - 3.1.3: Assign h_no = House/Flat/Room/Door/Block Number
 - 3.2: If(adh_db(f2) = h_no|| pan_db(f2) = h_no)
 - 3.2.1: Count += 2
 - 3.2.2: Trigger MaN Algorithm
 - 3.3: Else
 - 3.3.1: Search not found
 - 3.4: End If
 - 3.5: End If

B. Fig: SaI Algorithm Workflow



C. SaI Algorithm Working

We have two databases named aadhaar database (adh_db) and pan database (pan_db).

In Step 2, fetch the fields f1(pin code/Zip_code), f2(House / Flat / Room / Door / Block number), f3(full_name), f4(Date_of_Birth) and f5(Mobile_no).

In Step 3, user inputs a pin code value and is stored to a variable named ‘pin’. Then Searching starts by checking if the input value (pin) matches with the f1 field of both the databases. If search found then user enters the House / Flat/ Room / Door / Block number and is stored to a variable named ‘h_no’. Then search by checking if the input value (h_no) matches with the f2 field of both the databases. If search found goto MaN algorithm else search not found.

D. MaN Algorithm

- Step 1: Start
- Step 2: Read Date Of Birth
 - 2.1: Assign dob = Date Of Birth
 - 2.1.1: If(adh_db(f4)=dob && pan_db(f4)=dob)
 - 2.1.2: Date Of Birth Matches
 - 2.1.3: Count += 1
- Step 3: Read name as per aadhaar
 - 3.1: Assign string1 = adh_db(f3)
 - 3.1.1 Assign string2 = pan_db(f3)
 - 3.2: If (string1=string2)
 - Match success
 - 3.2.1: Count += 1
 - 3.3: Else

- 3.3.1: if (string1.length= string2.length)
Then
- 3.3.2: If (string1.prefix=string2.postfix &&
string1.postfix=string2.prefix)
Match Success
- 3.3.3: Count += 1

Step 4: Read Mobile Number

- 4.1: Assign mob_no=Mobile number
- 4.1.1:If (adh_db(f5) = mob_no || pan_db(f5) =
mob_no)
- 4.1.2: Mobile number matches
- 4.1.3: Count += 1

Step 5: Stop.

E. MaN Algorithm Workflow

F. MaN Algorithm Working

If the individual gets identified by the searching algorithm in its step 3, then moves to the MaN algorithm.

In Step 2, user inputs Date Of Birth and is stored to a variable named 'dob'. Then Searching starts by checking if the input value (dob) matches with the f4 field of both the databases. If a match is found then the count value incremented consequently.

In Step 3, user inputs name as per Aadhaar. Store the f3 field of Aadhaar database to the variable named 'string1' and f3 field of pan database to the variable named 'string2'. Then, checks whether string1 matches with string2. If match found count value increments as one. If match not found, check the length of both the strings. If lengths are equal check the prefix of string1 with the postfix of string2 and the postfix of string1 with the prefix of string2. If match found count value increments as one.

In Step 4, user inputs the mobile no and is stored to a variable named 'mob_no'. Then search by checking if the input value (mob_no) matches with the f5 field of both the databases. If match found count value increments as one.

Eg:- string1- John K string2- K John

string1.prefix = john && string2.postfix = john
string1.postfix = K && string2.prefix = K

Then we can say, match successful.

Thus we can conclude by saying that when count becomes 5, 100% match successful.

If count is 4, 80% match successful and the authority can decide whether their cards should be linked or not.

IV. LITERATURE REVIEW

We understand that According to the Finance Act 2017, the Aadhaar number or Aadhaar enrolment number is required to file income tax returns and apply for a new PAN. In addition, an existing PAN can be declared void if it is not linked to Aadhaar by the taxpayer within the period notified by the government. The steps have been taken to curb tax evasion and to destroy several PANs [4], since there are several cases of missing names on the PAN card and the Aadhaar are already reported earlier [3].

One of the major basis is that the Aadhaar does not demand the individual's full name be disclosed without initials if the PAN requires full name disclosure with the initials. Because of this, many people cannot connect PAN to the Aadhaar card. Under the Section 139AA Finance Act 2017, Aadhaar is now required to apply for a new PAN application and to file income tax returns [1][2]. Other government also says that the current PAN would be cancelled if Aadhaar was not connected to it; the reason is to manage tax elusion and get rid of multiple PANs.

It should be noted that Aadhaar is not a inimitable identity card. It contains no security features such as a PAN card and a Voter ID. You can download numerous sets of Aadhaar from your SSUP Portal. Aadhaar is used as address proof. UIDAI does not even verify applicants' addresses. Aadhaar was still taken as a verification of address in the banking and telecommunications industries [1][2].

Since security and data privacy are the main concern, UIDAI will soon implement a new standard of encryption on Aadhaar based devices which use biometrics. The pioneering standard of encryption is added as the third security layer. The first layer is the merchant / agency encryption and the second layer is the UIDAI layer itself. The third additional layer is implemented in the biometric apparatus itself. The authority of UIDAI convinced vendors and traders that their devices must be certified by STQ (Standardization Testing and Quality). Mean after the UIDAI emphasized that only authenticated users can transact Aadhaar [1][6].

There are many problems with the collection of biometric data by UID. Workers and the poor, the main goals of the Aadhaar process, often have no clearly defined fingerprints due to excessive manual labor. Even old people with "dry hands" were struggling. Weak iris scans of cataract patients also posed problems. In many cases, agencies have refused to register them and have defeated the very objective of including the poor and marginalized [13].

Karp-Rabin (KR) Algorithm 1987: This algorithm calculates the hashing function for each substring of m characters in the text and checks whether it is equal to the hashing function of the pattern [8]. For text of length n and p patterns of combined length m, its average and best case running time is $O(n+m)$ in space $O(p)$, but its worst-case time is $O(nm)$ [10].

Knuth-Morris-Pratt string-searching algorithm (or KMP algorithm) searches for occurrences of a "word" W within the main "text string" S by observing that the word itself contains sufficient information to determine where the next match could start, bypassing a re-examination of previously matched characters. The algorithm was designed by Donald Knuth and Vaughan Pratt in 1970, and by James H independently. Morris. Morris. This has been the first linear time algorithm to match strings [7][11].

V. CONCLUSION

In the existing system, only three fields (Name, Gender, DOB) were being checked which wouldn't be sufficient enough to identify the exact individual. Also if there is a major mismatch in the data being collected from both these official cards, either one of them were asked to be changed. According to the proposed system, it would be reliable for an individual to link their PAN and Aadhaar cards by the searching and matching procedure. The main advantage of doing so is time saving and reduce complexity in linking them and also an individual can do this process by themselves at home and make sure their cards have been linked. We have referred Fuzzy string matching algorithm, Knuth-Morris-Pratt (KMP) pattern searching algorithm, Dynamic Edit Distance algorithm and Rabin-Karp algorithm for creating an algorithm as mentioned in the proposed system.

VI. FUTURE WORK

This paper suggests an algorithmic approach for eliminating the inconsistency of linking Aadhaar cards with Pan cards of Indian citizens. According to this work there can be lot of future related researches done. Without giving more importance to name for linking documents of a person, the authority can link using biometric details such as fingerprints, QR code, iris scan etc. So by using these biometric details in each documents we can simply link the various identification cards of a single person. Now the existing system is not that much secure. In future, we have to make each individual's data more secure by providing some unique identification number which extracts all the data of a person and also assuring that the data is true and meaningful. Authority must also make sure that a person should not apply for the same card more than once.

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