AADHAAR- A Unique Identification Number: Opportunities and Challenges Ahead

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Abstract: *The Unique Identification Authority of India (UIDAI) with a launch of a nationwide Unique Identification Project named "Aadhaar," is perhaps one of the biggest projects in the world so far to provide a unique identity to its residents based on demographic as well as on biometric data. This project has opened the doors for people to avail benefits of various government sponsored schemes related to employment guarantee, access of public distribution system, micro-banking, health insurance, free education for children, etc. The present paper has highlighted the potential benefits of "Aadhaar" to the unprivileged people who had to prove their identities at every step to avail benefits of social welfare schemes and access public distribution system, etc. But the implementation of Aadhaar has also associated with challenges such as management of huge database of billion of people where enrollment, updating and authentication will go on side by side in addition to involvement of technological and strategic risks, and proper usage of UID System at the low level by various state agencies. There is need to have a strong coordination between UIDAI and state governments at the top level and between registrars, sub-registrars and enrolling agencies at the bottom level to have a complete and good quality data for enrolling and authentication of residents.*

Keywords: *UID, Aadhaar, UIDAI, CIDR, Biometric, Iris, Fingerprints, de-duplication.*

1. Introduction

In India, an inability to prove identity is one of the biggest barriers preventing the poor from accessing benefits and subsidies. Public as well as private sector agencies across the country typically require proof of identity before providing individuals with services [8]. Unfortunately, there is no single and nationally accepted, verified identity of resident that can be

used by the various service providing agencies such as banks, post offices, NGOs, public distribution system, education, social welfare schemes, etc. with ease and confidence. As a result, every time an individual has to undergo a full cycle of identity verification. Further, different service providers also often have different requirements of documents they demand for proving identification such as ration card, voter card, PAN, passport, etc. Such duplication of efforts are not only time consuming but also unnecessarily increase the overall costs of identification and extreme inconvenience at the end of individual in addition to duplicate or bogus identification, involvement of middlemen, etc. This approach is especially unfair to India's poor and underprivileged residents, who usually lack identity documentation, and find it difficult to meet the costs of multiple verification processes [8]. Keeping the above in mind, the Unique Identification Number has been conceived by the Government of India as a means for residents to clearly and uniquely verify their identity anywhere in the country [2]. The nation wide accepted and single identity number will eliminate frauds and duplicate identities so that the individuals will no longer be able to represent themselves differently to different agencies. This will result in significant savings to the state revenue. The need to prove identity only once also brings down transaction costs and elimination of middlemen for delivering social welfare programs directly to the beneficiaries by making them more inclusive of communities which were earlier deprived from such benefits due to lack of identifications [8]. A proper track of such social welfare schemes will also enable the government to monitor whether the intended beneficiaries actually receiving the benefits of such schemes or not. Aadhaar presents governments with a highly flexible solution – states can choose to implement Aadhaar within the PDS in stages, beginning with Aadhaar-based identification, and progressing towards Aadhaar-based authentication and an Aadhaar-enabled Management Information System (MIS) [4].

2. Aadhaar-Unique Identification Modal

The Unique Identification Authority of India (UIDAI) was set up by the Govt. of India on 28 January 2009. The purpose of the UIDAI is to issue

Unique Identification Numbers to all residents in the country [3]. The Unique Identification (Aadhaar) Number, which identifies a resident, will give individuals the means to clearly establish their identity to public and private agencies across the country. Aadhaar Number is provided during the initiation process called enrollment where a resident's demographic and biometric information are collected and uniqueness of the provided data is established through a process called de-duplication. Post de-duplication, an Aadhaar Number is issued and a letter is sent to resident informing the details [1]. The unique identification model of Aadhaar includes: 1) Central ID Data Repository- CIDR, 2) a network of Registrars who establish resident touch points through Enrolling Agencies. The CIDR is a central data repository, which will store resident demographic as well as biometric data, issue unique identification numbers, verify, authenticate and amend resident data. The Unique ID (UID) is a 12 digits random number and does not contain any intelligence to divide it further into area code, caste, race, etc. The demographic detail of the resident includes: Name, Date of birth, Gender, Father's/ Husband's/Guardian's name, Mother's/ Wife's/ Guardian's name, Address, etc. The biometric detail includes all ten finger prints, photograph and both iris scans of an individual. The UIDAI has partnership with a variety of agencies and service providers to enroll residents for UID numbers and verify their identity. The structure of these UID agencies is as follows: 1) Registrars- the state governments or central government agencies and may also be private sector participants such as banks and insurance firms, 2) Sub-Registrars – departments/entities that report to a specific registrar like Rural Development and Panchayati Raj Department, Civil Supplies Corporation, etc., and 3) Enrolling Agencies – entities those directly interact with and enroll residents into the CIDR. The UID system is both de-duplicated and universal discourages the residents from giving incorrect data at the time of enrollment. The UID implementation modal is shown in figure 1.
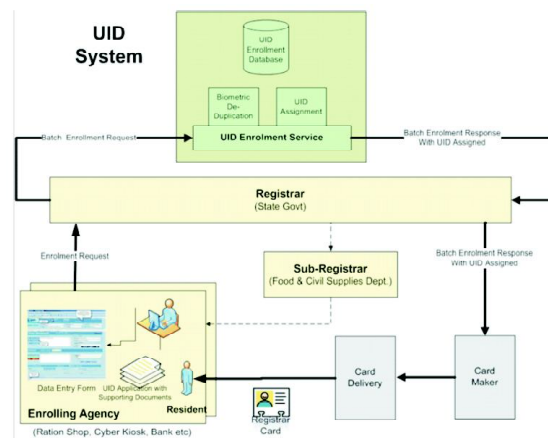
Figure 1: UID Implementation Modal
Source: UIDAI Strategy Overview, Planning Commission, Govt. of India, April, 2010

3. Technology Architecture of Unique Identification System

The Central ID Data Repository is the central database of all residents that contains both demographic as well as biometric database. The key technology components of the UID system are [3]: 1) UID Server that provides the enrollment and the authentication service. These services will be available online for state governments like Registrars and their authenticating agencies for usage i.e. identification of beneficiaries. The backend servers are architected for the high demands of the 1: N biometric de-duplication as well as the large peak loads from authentication requests, 2) Biometric Sub-system is central to the UID system for enrolling as well as authenticating residents. A multi-modal biometric solution is designed to achieve a high accuracy and quality of data. The 1: N de-duplication is the most computing-intensive operation of the UID system and demands state-of-the-art robust technological solutions such as hashing, indexing, distributed processing, and in-memory databases using multiple-biometric modes to get acceptable performance, 3) Enrolment Client application captures and validates demographic and biometric data at the enrolling sites, 4) Network is a critical component of the system of

UID system because all enrollment and authentication services are available online, 5) Infrastructure Security secures all the above components from logical/physical attacks. This includes: server security using firewall, intrusion prevention and detection systems (IPS, IDS), network, client security, etc.

4. Salient Features and Benefits of Aadhaar

Aadhaar UID has the following salient features and benefits in the form of opportunities for the residents as well as to the state agencies [2]:

1. One Aadhaar number means only one beneficiary. Aadhaar is a unique number, and no resident can have a duplicate number since it is linked to their individual biometrics- finger prints and iris. This enables to identifying fake and ghost identities which result in leakages in legacy Public Distribution System and other social welfare schemes.

2. Aadhaar is a nation wide universal number and migration of beneficiaries from one state to another will not hinder them to get registered again at new place to avail benefits of governmental social welfare schemes. This is because, there is a Central Unique Identification Database which can be used to confirm the identity of an individual.

3. It also includes residents who don't have any existing identity documents. A problem in reaching benefits to poor and marginalized residents is that they often lack the identification documents they need to receive benefits of government sponsored schemes.

4. The UID-enabled-bank account network will offer a secure and low cost platform to directly remit benefits to residents without involvement of heavy costs associated in present benefit distribution system. This will also eliminate the involvement of middlemen because the benefits are directly transferred into the beneficiaries' bank account.

5. The UIDAI offers both online and offline authentication services for agencies who wish to validate a resident's identity. This service will enable confirmation of the entitlement actually reaching the intended beneficiary or not?

6. Clear accountability and transparent monitoring would significantly improve access and quality of entitlements to beneficiaries and the agency alike. The residents will be able to access up-to-date information about their entitlements, demand services and redress their grievances directly from their mobile phone, kiosks or other means.

5. Challenges for Implementation of Aadhaar-UID System

1. One of the unique challenges in executing the UID project is its scale. Due to large size of India's population which is at present is more than 1.21 billion is perhaps the largest governance-related exercise in the world where enrollment, de-duplication, and authentication of residents have to be done simultaneously [8]. This involves high end computational resources and transfer of information on network in an authentic, integrated and securely manner in addition to deployment of huge skilled manpower and need of strong coordination among state agencies like registrars, sub-registrars and enrolling agencies with UIDAI.

2. The biometric de-duplication algorithm needs to scale towards checking biometric against everyone of 1.21 billion people to ensure uniqueness. The UIDAI did matching analysis as a case study on two sets of 20,000 biometrics i.e. 40,000 biometrics where each set of biometric was matched against every other set of biometric in the data set [9].The computation is very complex and here is the proof: for a sample of 40,000 biometrics, there was a need of $40,000 \times 39,999 / 2 = 799,980,000$ unique pairs of biometrics. After enrolling whole population of India i.e. 1.2 billion which means 1.2×10^9, the total number of comparisons between pairs of biometrics that would need to be made to prove uniqueness is 7.2×10^{17}. It would take a very long time for 7.2×10^{17} comparisons [7].

3. The FPIR (i.e. the possibility that a person is mistaken to be a different person) is 0.0025% which means 2½ false positives cases on average for every 100,000 comparisons. Since, total number of comparisons are 7.2×10^{17} for a population of 1.2 billion so there will be $(7.2 \times 10^{17}) \times (2.5 \times 10^{-5}) = 1.8 \times 10^{13}$ FPIR. That's 18,000,000,000,000 average false

positives for people to be investigated and resolved for uniqueness using biometrics [7].

4.   The authenticating service, which may be used by tens of thousands of points of service centres across the country, is again a challenging job for UIDAI [8]. Is the UID system robust enough to handle hundreds of thousands of transactions per second specially when single person's biometric data has to be compared with rest of the persons' biometric data separately?

5.   The project will have to handle records that approach 1.2 billion in number. This creates significant risks in biometric de-duplication as well as in administration, storage, and continued expansion of infrastructure [8].

6.   Technology is a key part of the UID program, and this is the first time in the world that storage, authentication and de-duplication of biometrics are being attempted simultaneously on this scale. The biggest question "Is India IT ready i.e. requisite robust infrastructure, sufficient and continuous electric power, and strong communication system for online authentication of demographic as well as bio-metric information from point of service centres located even in remote villages where communication and continuous power supply are the biggest problems?"

7.   Aadhaar with its biometrics and the ability to facilitate convergence of information-bona fide or otherwise-has the potential to compromise privacy and put people in trouble. In one of examples quoted [6], Mrs. Saralamma was a retired school teacher and recently, she has received some arrears. She wanted to purchase some silverware for her only daughter. She has checked out a specific set, but decided not to buy, as the cost was beyond her budget. After a few days, to her surprise, she got a call from a security agency. There is a theft at the same jewelry shop where she had visited. One of the items in the set that she had looked at was stolen. As part of the investigation, fingerprints were collected from items in and around the set. They were run against the biometrics already stored and alas, one of the fingerprints on the silverware matches that of Saralamma. She was asked to explain as

to why she should not be considered a suspect**.** So, the UIDAI will have to ensure that resident data is not shared or compromised by third party agencies.

8.   The UID Number is a lifetime number, but the biometric information contained in the central database will have to be regularly updated. Children may have to update their biometric information every five years, while adults update their information every ten years. The demographic information that the CIDR holds on the resident may also become outdated. Data which are likely to change may be the 'present address', etc. after migration from one place to another and even after transfer [8].

9.   A challenge of full enrollment is very hard to achieve because every day approximately 60,000 babies are born in the country. First, their biometrics is not stable, they have to be re-scanned at a later age. Second, names are often not given in India at the time of birth registration.

10. It is also necessary to record deaths in UID system. The UID system will not remove a record upon the person's death; it will simply mark it as 'deceased' and hence will render it inactive for the purposes of authentication [8]. But here is the problem about the length of the UID Number that is of only 12 digits in which one digit is a checksum and rest 11 digits are number for authentication [5]. The present population of India is nearly 1.21 billion and will increase further. Since actual length is only 11 digits and after some years this limit will exhaust like IPv4 network IP addresses.

6. Conclusion

India is the first country in the world which has initiated a challenging project to implement a biometric-based unique ID system for its residents on such a large scale. The UID system will empower the resident with single, nationally accepted and verified identity and elimination of unnecessarily costs of identification and inconvenience. It will also facilitate the government to have a clear view of India's actual population, socially deprived sections, real beneficiaries of social welfare schemes, formulate new social

development plans and policies on targeted population, monitor money and resource flows within various sections of society across the country. Being a new system that too on such a large pollution of about 1.21 billion, the UID has certain risks like highly dependent on technological solutions to manage enrollment, de-duplication, and authentication of residents simultaneously and completely online using CIDR. The UID project also needs support from state governments across India to enroll residents based on set of standards prescribed by UIDAI to get quality data by eliminating duplicate and bogus data at the initial stage of enrollment. The success of this project is dependent on linking public services to the UID and regular updating of CIDR. The UIDAI will have to address the risks carefully like obsolescence of data after some time and maintenance of its quality by choosing the right technology to manage huge volume of demographic as well as biometric data towards the best possible result.

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