International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Efficient Retrieval of Medical Data from Aadhaar Cards

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Abstract: ***Healthcare management systems are designed to enable healthcare providers collect, store, retrieve and exchange patient healthcare information more efficiently and enable better patient care. It also helps to provide efficient and suitable healthcare facilities to the patients catering to their specific needs all the while suggesting medical professionals- doctors, nurses, and medical receptionists. We intend to build a multi-user, interactive case management system designed to meet the needs of diverse organizations to provide and track proper treatment in real time. The personalized approach of the app will alleviate stress and on the patients as well as on the healthcare providers by improving communication between the two. The software is delivered on demand via the firebase, and so, the healthcare providers are especially mindful about maintaining the privacy and security of the patient protected healthcare information.***

Keywords: NGOs, Patients, Doctors, Aadhaar Cards, Unique ID, Medical Data

1. Introduction

The app will function on four different ends- **the patient, healthcare provider, nurses and medical receptionists, and government NGOs.** The Aadhar card function will link the individual's protected healthcare information to ensure privacy and security and enable. The patients will be able to view their medical history and search for a suitable medical help according to their specific ailments. The doctors will be able to view and access their patients' medical history and provide the appropriate medical facilities accordingly. The nurses and medical receptionists will be able to view and check the availability of the clinical resources in their assigned area. The government NGO end will be able to extend the resources required in which ever area that is lacking.

All in all this will be a handy, go-to clinic for the patients where they can access and know all about them, medically, and since almost everyone has access to smartphones, it will be easy to reach a far out audience with just a simple task of putting the application on the online app stores across all platforms providing ease of access to people owning smartphones.

India has adopted an identification system commonly known as Aadhar or Unique Identification Number (UID) hat would cater to all the requirements of people residing in India. Individual identification system is popular in many nations as it helps the government of India to provide targeted services to individuals and enhance safety and security of the country. Take for example, the United States of America, where it is referred to as the Social Security Number. This unique code is a nine-digit number that is issued to both the permanent citizens of the United States as well as the temporary citizens who are working there. India, as a boost to its development efforts, also adopted this concept and thus, Aadhar Card came into existence.

The Unique Identification Authority of India (UIDAI) was created and given the task of developing and issuing the Aadhar Card. The agency was established by the Government of India in January 2009 and it operates under the central government. The purpose of Unique Identification Authority of India is to collect the biometric as well as the demographic details of every resident in India.

After the data is collected, it is stored in a centralized database system called the UID Database. The main data centre of the Unique Identification Authority of India where the data storage of Aadhaar takes place is situated at the Industrial Model Township (IMT) in Manesar, Haryana. The UIDAI then simultaneously issues the 12 digit unique identification number or the UID to the Indian resident, also known as Aadhaar card in India. The project boasts of being the largest national identification number project in the entire world.

The Aadhar Card contains the Aadhaar Number of the card holder. It is a unique 12-digit number allotted to each individual who opts for the card. The UID/Aadhaar is the number that contains the collected biometric and demographic data and details of the residents of India. Any citizen who resides in India, and fulfils all the criteria mentioned by the UIDAI irrespective of their caste, creed, region, religion or colour can put forward their enrolment for the Aadhar card.

Applying and consequently availing the Aadhar Card is voluntary. It is not mandatory on the part of any Indian citizen to opt for this card. It solely depends on the personal choice of the individual whether he wishes to get the Aadhar number and facilities associated with it or not. However, the Aadhar Card has a host of benefits which is why every individual willingly opts for the enrolment. The card is thus, gaining popularity since the time it was first launched on 28 January 2009.

Definitions and Acronyms

Administrator	A person who manages and supports a computer system or network, as in a business or other organization
Author	Person submitting an article to be reviewed. In case of multiple authors, this term refers to the principal author, with whom all communication is made.
Database	Collection of all the information monitored by database this system.
Documentation	Material that provides official information or evidence or that serves as a record.
Field	A cell within a form.
GUI	Graphical User Interface
Interface	In computing, an interface is a shared boundary across which two or more separate components of a computer system exchange information
Software Requirements Specification	A document that completely describes all of the requirements functions of a proposed system and the specification constraints under which it must operate. For example, this document.

2. Literature Survey

A. Aadhaar Card: Challenges and Impact on Digital Transformation

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Keywords: Aadhaar card, UIDAI, data privacy, data protection

Aadhaar project is one of the significant projects in India to bring the universal trend of digital innovation. The launch of this project was focused on the inter-operability of various e-governance functionalities to ensure the optimal utilization of Information, Communication and Technology Infrastructure. Towards this Government of India has recently made Aadhaar card mandatory for many government applications, and also has promoted Aadhaar enabled transactions

Data is an asset of an organization, and Privacy is some sort of assurance that an individual requires from an organization. Therefore Data privacy together refers to the ability of an organization that determines which data has to be shared with third party. As the Aadhaar card contains both the demographic and biometric data, so it becomes a risk for an individual as well as to the government if the data are insecure. It is to be noticed that Clause 30 of IT Act 2000 states that biometric or demographic data are recognized as an 'electronic and sensitive data of an individual', and if someone tries to steal it, there is a Clause 34- 47 under Chapter VII of IT Act 2000 which deals with punishment related to it, and also is entitled as 'Offences and Penalties' 35. Though there are strict laws but still whether the data in Aadhaar database are secure or not has always been a question. According to The Times of India 36, Maharashtra accepted that their 3 lakhs of Aadhaar data got lost with PAN. The incident happened when the IT Department was uploading the biometric information and PAN data to the UIDAI centralized server that is in Bengaluru (then Bangalore) from Mumbai, due to the crash of hard disk. In fact the data were being uploaded and encrypted using strong algorithm, and when the Headquarters were downloading the data, they couldn't decrypt it. Therefore many applicants, who complained about this, were asked to re-register for it. Later the State (Mumbai) IT department stated that the data belonged to people of Mumbai, and the lost data are being fully secured which can only be opened if you have 'keys and multi clues'. The State ensures that the data are safe but such type of issues has already raised serious concern.

Data Redundancy

According to The Times of India 43, there was an Aadhaar controversy in which the Aadhaar card were being considered invalid on the various factors. In this case a senior citizen got his Aadhaar card without any hassle or without any problem, but the problem aroused when he got the Aadhaar card mentioning the 'Year of Birth' instead of 'Date of Birth' which was considered as an invalid Aadhaar card. Later the Secretary of State (Mumbai) IT Department considered it to be valid as the senior citizens who were born before the year 1989, can use Year of Birth as they didn't have the provision for birth certificate at that time. Recently, Aadhaar has been made mandatory to be linked with PAN card, since then various cases of mismatching names on PAN card and Aadhaar card have also been reported

According to Live mint 45, UIDAI filed a complaint on which Delhi police has lodged an FIR in which two different names enrolled with same biometric. The Deputy Director of UIDAI regional office in Pragati Maiden, Delhi told police that on March 18, a person named Raj Kishore Roy enrolled for Aadhaar and submitted his demographic and biometric details. However UIDAI found that on March 17, a person named Deben Roy enrolled for Aadhaar with same biometric information. This example also raises serious concerns. However later UIDAI lodged a complaint under Aadhar act as cheating by impersonation.

B. An Effective mechanism for Ensuring Security of QR Code

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QR-code stand for Quick Response Code, which is well known 2 dimensional barcode industrial as it, have high efficiency in accuracy and reading speed. QR-code is continuously developed by Denso Wave company [1], as development today its able to store more information. QR code is able to store up to 7089 numeric. It also able to store in different type of format such as Numeric Characters, Alphabetic Characters, Kanji Characters, Symbols, Binary and Control Code. QR Codes have already overtaken the conventional bar codes because of the main fact that the capacity of data that can be stored by a conventional bar code is very much less when compared to the data that can be stored by a 2-D barcode, the

QR Code. QR Code contains data both in horizontal and vertical positions.

QR Codes have already overtaken the classical barcode in popularity in some areas. This stems in many cases from the fact that a typical barcode can only hold a maximum of 20 digits, whereas as QR Code can hold up to 7, 089 characters. QR Codes are capable of encoding the same amount of data in approximately one tenth the space of a traditional bar code. A great feature of QR Codes is that they do not need to be scanned from one particular angle, as QR Codes can be read regardless of their positioning. QR Codes can be easily decoded with a mobile phone with appropriate software (Kaywa Reader). Secure communication can also be established using QR Encoding techniques.

3. Comparative Analysis

This study is conducted to compare the Indian UID also known as Aadhar number with the identity of other countries. Here, this paper presents the study of country wise identity techniques with the biometric technique used in it. The paper gives information about how biometric identification has been used for economic, political, and also for social purposes in developing countries.

Aadhaar was constituted under the Planning Commission. The Aadhaar number was established as a single proof of identity and address for resident in India that can be used to authenticate the identity of an individual in transactions with organisations that have adopted the Aadhar number. The scheme has been promoted as a tool for reducing fraud, theft cases in the public distribution system and enabling the government to deliver better benefits for public. The Aadhaar number is available to any resident of India.

SSN Vs Aadhaar

SSN was created as a number record keeping scheme for government services: The Social Security Act provides for the creation of a record keeping scheme - the SSN. Originally, the SSN was used as a means to track an individual's earnings in the Social Security system In 1943 via an executive order, the number was adopted across Federal agencies. Eventually the number has evolved from being a record keeping scheme into a means of identity. In 1977 it was clarified by the Carter administration that the number could act as a means to validate the status of an individual (for example if he or she could legally work in the country) but that it was not to serve as a national identity document. Today the SSN serves as a number for tracking individuals in the social security system and as one (among other) form of identification for different services and businesses. Alone, the SSN card does not serve proof of identity, citizenship, and it cannot be used to transact with and does not have the ability to store information.

Aadhaar was created as a biometric based authenticator and a single unique proof of identity: The Aadhaar number was established as a single proof of identity and address for any resident in India that can be used to authenticate the identity of an individual in transactions with organizations that have adopted the number. The scheme as been promoted as a tool for reducing fraud in the public distribution system and enabling the government to better deliver public benefits.

Verification

The SSN can be verified only in certain circumstances: The SSA will only respond to requests for SSN verification in certain circumstances:

- Before issuing a replacement SSN, posting a wage item to the Master Earnings File, or establishing a claims record - the SSA will verify that the name and the number match as per their records.
- When legally permitted, the SSA verification system will verify SSNs for government agencies.
- When legally permitted the SSA verification system will verify a worker's SSN for pre-registered and approved private employers.
- If an individual has provided his/her consent, the SSA will verify a SSN request from a third party.

For verification the SSN number must be submitted with an accompanying name to be matched to and additional information such as date of birth, fathers name, mothers name etc. When verifying submitted SSN's, the system will respond with either confirmation that the information matches or that it does not match. It is important to note that because SSN is verified only in certain circumstances, it is not guaranteed that the person providing an SSN number is the person whom the number was assigned.

The Aadhaar number can be verified in any transaction: If an organization, department, or platform has adopted the Aadhaar number as a form of authentication, they can send requests for verification to the UIDAI. The UIDAI will respond with a yes or no answer. When using their Aadhaar number as a form of authentication individuals can submit their number and demographic information or their number and biometrics for verification.

Public and private entities can request Aadhaar: The Aadhaar number can be adopted by any public or private entity as a single means of identifying an individual. The UIDAI has stated that the Aadhaar number is not mandatory, and the Supreme Court of India has clarified that services cannot be denied on the grounds that an individual does not have an Aadhaar number.

SQL Databases Vs Firebase as a backend server

Since we are going to be linking to something such as a web or mobile application where the data is constantly changing by multiple users (all accessing the same database stored in the cloud) we used firebase for our application.

Pros

- If the app does run of a centralized DB, and is updated by a lot of users - then it's more than capable of handling the Real-Time data updates between devices.
- Stored in the cloud so readily available everywhere.
- Cross Platform API (If you are using this DB with an App)
- They Host the data. -Meaning if you are storing a lot of data, you don't have to worry about hardware!

Cons

- Unless our app runs of one centralized database updated by a vast quantity of users, it's a major overkill.
- Storage format is entirely different to that of SQL, (Firebase uses JSON) so you wouldn't be able to migrate that easily.
- Reporting tools won't be anywhere near the ones of standard SQL.
- Costs! -Limited to 50 Connections and 100mb of Storage!

Whereas, MySQL is an open-source relational database management system (RDBMS)

MySQL is offered under two different editions: the open source MySQL Community Server and the proprietary Enterprise Server.[70] MySQL Enterprise Server is differentiated by a series of proprietary extensions which install as server plugins, but otherwise shares the version numbering system and is built from the same code base.

Major features as available in MySQL are:

- A broad subset of ANSI SQL 99, as well as extensions
- Cross-platform support
- Stored procedures, using a procedural language that closely adheres to SQL/PSM[71]
- Triggers
- Cursors
- Updatable views
- Online DDL when using the InnoDB Storage Engine. etc but since our application used dynamic content that has to be linked to some application, Firebase is a better way to go.

4. Methodology

Health cube is an application that scans user's Aadhar card and tells the about the vaccines they have gotten in their lifetime. The main part of the job was to collect the data that would be displayed when the user scans their Aadhar cards, also it includes information about doctors available in a particular hospital.

The data for the Aadhar card is actually government collected data, for the generation of Aadhar cards. For the application Health cube, we used the Aadhar API that has the necessary data which is required for the application to work. The Aadhar API is a JSON object file and the application uses Aadhar authentication to provide the services.

Aadhaar authentication is the process wherein Aadhaar Number, along with other attributes, including biometrics, are submitted online to the CIDR for its verification on the basis of information or data or documents available with it. Aadhaar authentication provides several ways in which a resident can authenticate themselves using the system. At a high level, authentication can be 'Demographic Authentication' and/or 'Biometric Authentication'. During the authentication transaction, the resident's record is first selected using the Aadhaar Number and then the demographic/biometric inputs are matched against the stored data which was provided by the resident during enrolment/update process. Fingerprints in the input are matched against all stored 10 fingerprints.

For the part where the application tells about doctors, it is collected from a random hospital that will be willing to collaborate with the application.

The next part involves saving data on firebase. The basic database write operation is a set which saves new data to the specified database reference, replacing any existing data at that path. The To data for your app is stored at a database reference

Let's start by saving some user data. We'll store each user by a unique username, and we'll also store their full name and date of birth. Since each user will have a unique username, it makes sense to use the set method here instead of the push method since you already have the key and don't need to create one.

First, create a database reference to your user data. Then use set () / setValue() to save a user object to the database with the user's username, full name, and birthday. You can pass set a string, number, boolean, null, array or any JSON object. Passing null will remove the data at the specified location.

For authenticating a user most apps need to know the identity of a user. Knowing a user's identity allows an app to securely save user data in the cloud and provide the same personalized experience across all of the user's devices.

Firebase Authentication provides backend services, easy-to-use SDKs, and ready-made UI libraries to authenticate users to your app. It supports authentication using passwords, phone numbers, popular federated identity providers like Google, Facebook and Twitter, and more.

To sign a user into your app, you first get authentication credentials from the user. These credentials can be the user's email address and password, or an OAuth token from a federated identity provider. Then, you pass these credentials to the Firebase Authentication SDK. Our backend services will then verify those credentials and return a response to the client. After a successful sign in, you can access the user's basic profile information, and you can control the user's access to data stored in other Firebase products. You can also use the provided authentication token to verify the identity of users in your own backend services.

5. Design Considerations

1)Assumptions
The assumption we have made in the application is that all the users have Aadhar card and can only access the application using the Aadhar card. Also we have made the application for Indian users since it only works with the Aadhar API.

2) Constraints
The only constraint with the application is that, if the user doesn't have an Aadhar card, he cannot use the services provided by our application. Also one of the concern is that, as of now we are only available on iOS devices and will take some time to develop this for android or other devices. Also we need a proper internet connection and working camera for the application to be functional.

3) System Environment
The main component of our application is the application which will work only on iOS devices. The devices should also have working internet connection. Users should also ensure that the camera of their device is working properly.

4) Design Methodology
The methodology is designed to be used by patients to explore doctors, find their vaccines and book appointments. The methodology has been informed by the initial literature review and by critical consideration and evaluation.

The methodology is made up of three stages:
- Planning and design
- Development
- Performance and evaluation

The planning and design stage
The planning and design stage is concerned primarily with pedagogic considerations. Taking into account the context of the unit/ module. This stage is primarily intended to be proposed to a customer for its approval and a reference for developing the first version of the system for the development team. The basic GUI is set up.

The development stage
The development stage is concerned with the creation of resources to support the development of Health cube. In this stage the project is made more developed by regular and better updates. The formation of the design of the application is kept in constant working with the basic GUI in mind.

The performance and evaluation stage
The performance and evaluation stage is concerned with piloting, performing and improving the application.

Development Methods

Incremental software development is better than any other approach for most business, e-commerce, and personal systems. By developing the software incrementally, it is cheaper and easier to make changes in the software as it is being developed. Compared to the other model, incremental development has three important benefits:

The **cost of accommodating changing** requirements is reduced. The amount of analysis and documentation that has to be redone is much less than that's required with waterfall model.

It's easier to get **customer feedback** on the work done during development that when they system is fully developed, tested, and delivered.

More **rapid delivery** of useful software is possible even if all the functionally hasn't been included. Customers are able to use and gain value from the software earlier than it's possible with other models

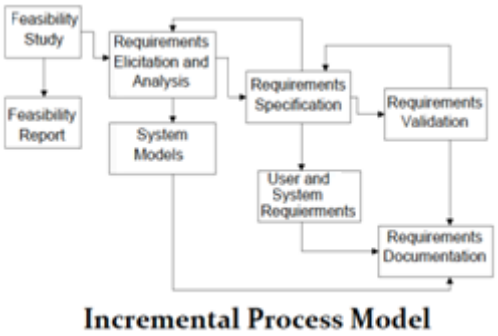

Figure 1: Showcases the ICM or process model used in this project

6. Design

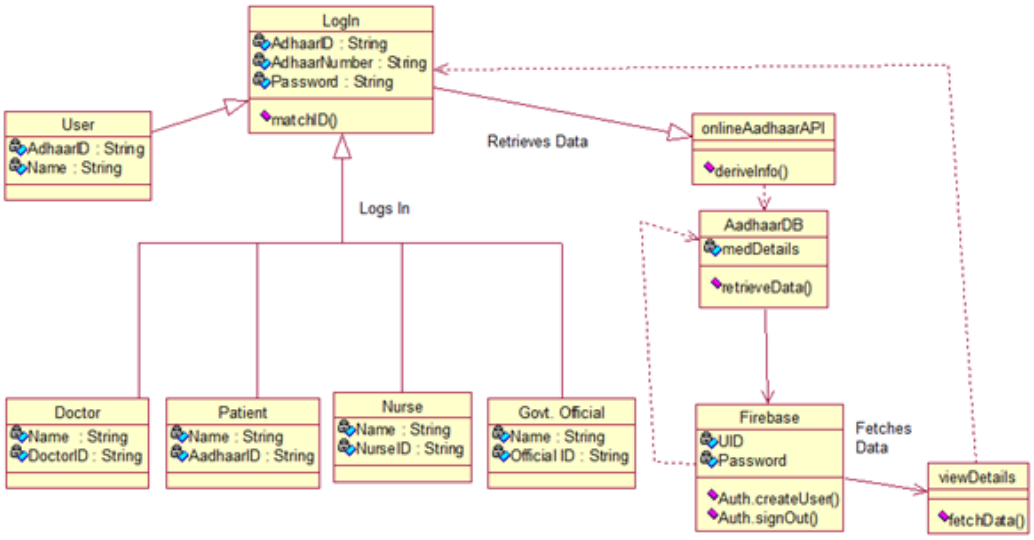

Figure 2: UML Class Diagram

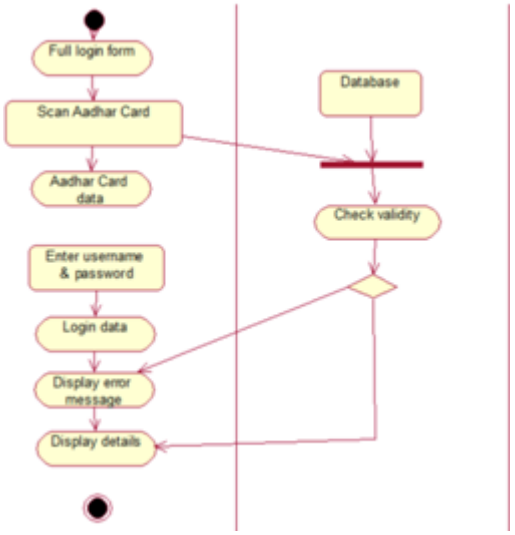

Figure 3: Use Case Diagram

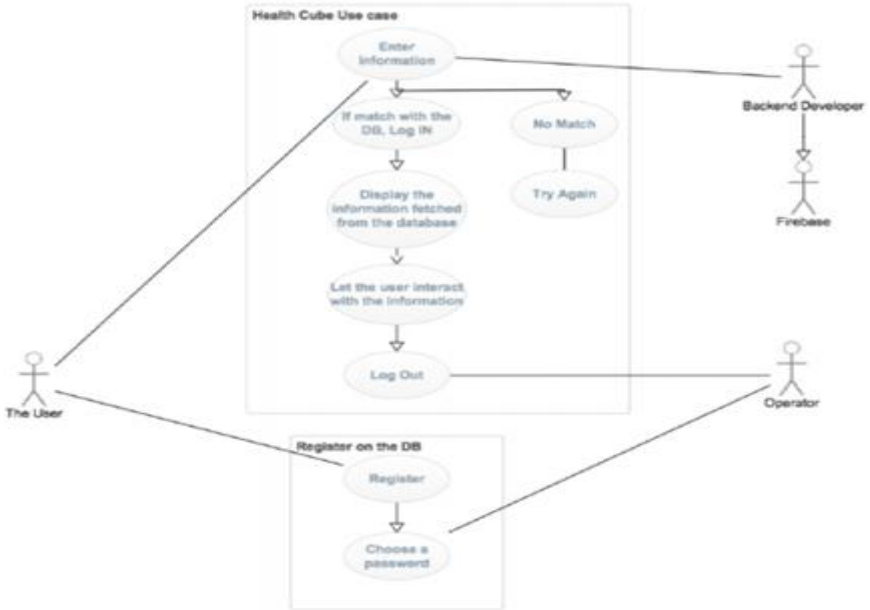

Figure 4: Sequence Diagram

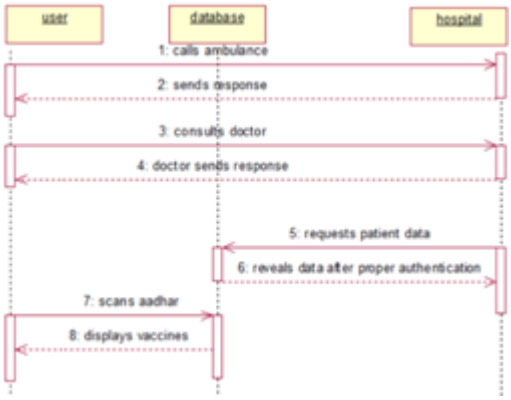

Figure 5: State Chart

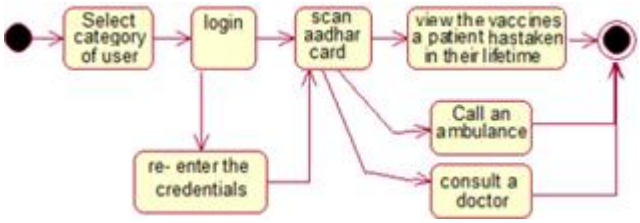

Figure 6: Activity Diagram

7. Conclusion

The Aadhaar QR Code is in turn a very secure and successful way of implementing a person's identity. We were successfully able to retrieve data from a User's Aadhaar Unique ID using Health Cube, our iOS Application and display the same. This will prove to be a massive step in showing a person's medical vaccination details and can safely keep all their medical data in one save and secure google firebase Database. It's reliability and functionality will prove to be a great way of ensuring a successful, handy mobile applications for Aadhaar card users

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