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Personalized Healthcare for Victims in Road Accidents Using Big Data

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Abstract— Healthcare is moving from a disease-centred model towards a patient-centred model. Our work is to provide personalized medicine for the person injured in road accidents. When a road accident happens the injured person is taken to nearby hospital and first aid may be provided. But his medical history is needed for further treatment. For example, the person may be prone to allergies for specific medicines or he may have any disease like diabetics, AIDS, etc. Our model provides a framework by which an individual is given treatment without any delay in an effective manner as well as provides information to their family. Medical history of individuals based on DNA samples is maintained in a database indexed with the unique identification numbers i.e. the aadhar number. At the place accident happened we may get any identity proof of the injured person such as licence, vehicle number, passport or ration card. Data we get is passed to a framework that takes any one of the above proof and provide as the Aadhar number. The doctor by using this aadhar number accesses the details of the respective individual's medical history and provides treatment based on that. The medical history reflects about his previous treatments on specific disease or drug allergies (i.e. prone to allergy for particular antibiotic) and also list out the contact numbers of the patients family members. With this we can provide efficient treatment as well as give information to their family members.

Keywords— Personalized healthcare, Big data, DNA

I. INTRODUCTION

Road accidents are the biggest killer in India. Statistics suggests that one person dies in a road accident in India every four minutes. A report released by India's ministry of road transport says that

- More than 140,000 people were killed on India's roads in 2015, according to figures released by the government.
- 500,279 people were injured in road accidents in 2015.
- 400 road deaths take place every day on India's roads

Main cause of road accidents and crashes are due to human errors. Some of the common behaviour of humans which results in accident are,

1. Over Speeding
2. Drunken Driving
3. Distractions to Driver
4. Red Light Jumping
5. Avoiding Safety Gears like Seat belts and Helmets
6. Non-adherence to lane driving and overtaking in a wrong manner

Once accident happens, victim will be taken to the hospital. On the way first aid will be provided. After reaching to the hospital, doctor will treat the patient without his medical history. Victim may be prone to some vaccines or allergies. Doctors won't have enough time to analyse about patient's health and his medical history. Their only goal will be towards saving the patient.

II. HEALTHCARE AND PERSONALIZED MEDICINE

In a disease-centered model, physicians decision making is centered on the clinical expertise, and data from medical evidence and various tests.[1] In a patient-centered model, patients actively participate in their own care and receive services focused on individual needs and preferences, informed by advice and oversight from their healthcare providers. In patient centric model the treatment is given based on their DNA or RNA. Because some medicines react well and quick for few patients but it may lead to some other defects or even death due to unacceptability of medicine by his body.

The terms 'personalized' or 'precision' medicine refer to the grouping of patients based on risk of disease, or response to therapy, using diagnostic tests or techniques. This approach provides an opportunity for the doctors to provide treatment based on their genetic behavior of the individual and responsiveness to the drugs.

Every person has a unique variation of the human genome. Modern advances in personalized medicine rely on technology that confirms a patient's fundamental biology, DNA, RNA, or protein, which ultimately leads to confirming disease. For example, personalized techniques such as genome sequencing can reveal mutations in DNA that influence diseases ranging from cystic fibrosis to cancer. Another method, called RNA-seq, can show which RNA molecules are involved with specific diseases. The concepts of personalized medicine can be applied to new and transformative approaches to health care. Personalized health care is based on the dynamics of systems biology and uses predictive tools to evaluate health risks and to design personalized health plans to help patients mitigate risks,prevent disease and to treat it with precision when it occurs.

A. Difficulties in existing system:

1. If suppose the person is prone to allergies or his body does not accept the medicine provided by the doctors they it will aggravate some other problem in their body which may even lead to death of the individual.
2. The family members may not know about the accident.
3. No Prediction of victims medical history.
4. Increased medical cost. Every time when a person goes to a doctor lot of tests has to be taken for analysis.

III. PROPOSED MODEL

In our proposed model the work is split into two modules.

Module 1: Obtaining the aadhar number of the victim

Module 2: Tracing the medical history

A. Obtaining the aadhar number of the victim

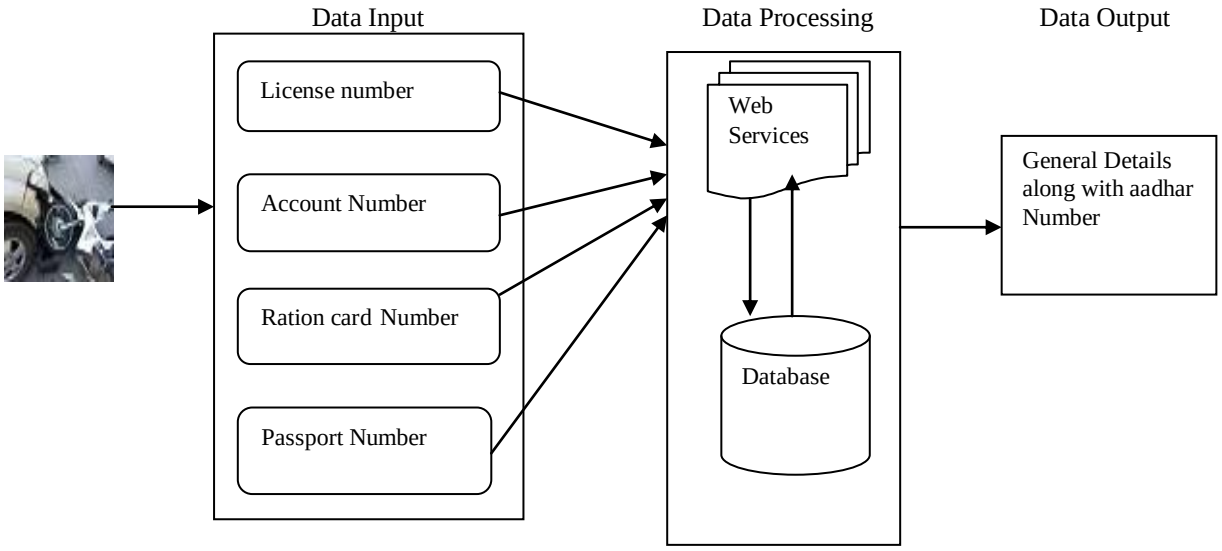

Fig. 1: Framework for obtaining the aadhar number

At the place of accident we may get some information about the injured person. For example 95% of people will be having their license or may have bank pass book or ration card or passport. As we are in a progress towards Digital India every citizen is provided unique identification number called aadhar number and is being linked with all the documents of every individual. In our work we have created four web services

1. RTO Web Service: If vehicle number is given as input then it returns Vehicle owner, owners and aadhar number. If license number is provided as input then service returns the general details like name, validity period and aadhar number.
2. Bank Web Service: When account number is given the input then service returns all details of account holder along with aadhar number.
3. Civil Web Service: When a injured person is having a ratio card and no other proof then the unique number in the ration card is given as input then the service will return the family member details and aadhar.
4. Passport Web Service: If suppose the injured person is having a passport then passport number is fed as input then the service returns all details of the person and aadhar number.

The beauty of this framework is whatever input we provide the web services interact with database and provide the contact details of the individual and aadhar number. With the contact details the information about the accident is passed to the family members of the injured person.

B. Tracing the Medical History

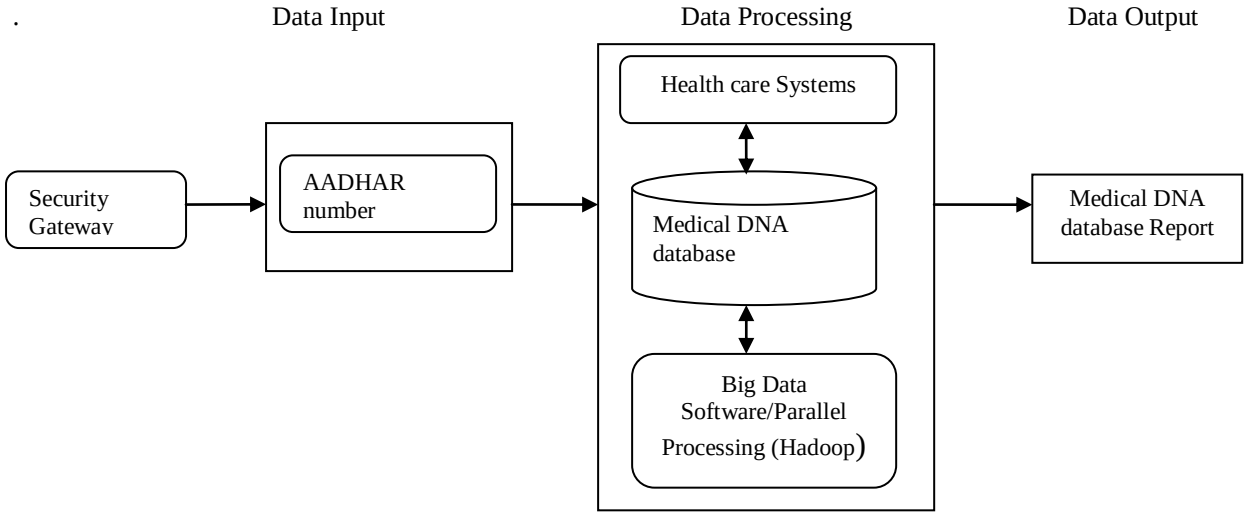

Fig .2: Proposed Framework for obtaining the medical record

Only the doctors are given privilege and secured login portal for accessing the medical database. Once they log in they will receive one time password with which they can proceed. By this we incorporate security in our system. To trace the medical history the doctor provides the aadhar number that is unique for every citizen as the input to the framework. This input is processed, linked with central cloud database and it fetches the medical report of the individual. This report does not disclose any DNA samples, it just describes about the disease that the individual has and also unacceptable medicines which aggravates some other problems.

So, with this medical history the doctors can effectively provide treatment without any errors that leads to death of individual.

Advantages:

1. Proper treatment can be given to the person based on medical history
2. Information is passed to the individual's family quickly.
3. personalized and prospective healthcare
4. improved chronic disease management
5. reduction in medical errors
6. reduced healthcare costs
7. best practices and efficiencies in delivery of healthcare

C. DNA Database

A DNA database or DNA databank is a database of DNA profiles. A DNA database can be used in the analysis of genetic diseases, genetic fingerprinting for criminology, or genetic genealogy. DNA databases may be public or private, but the largest ones are national DNA databases. [2]

Types of DNA Database

1) Forensic DNA database

A centralised database for storing DNA profiles of individuals that enables searching and comparing of DNA samples collected from a crime scene against stored profiles.

Function: to produce matches between the suspected individual and crime scene bio-markers, and then provides evidence to support criminal investigations, and also leads to identify potential suspects in the criminal investigation. Majority of the National DNA databases are used for forensic purposes.

2) Genetic genealogy database

A genetic genealogy database is a DNA database of genealogical DNA test results. GenBank is a public genetic genealogy database that stores genome sequences submitted by many genetic genealogists. The files stored in GenBank are divided into different groups, such as BCT (bacterial), VRL (viruses), PRI (primates)…etc. People can access GenBank from NCBI's retrieval system, and then use "BLAST" function to identify a certain sequence within the GenBank or to find the similarities between two sequences.[3]

3) Medical DNA database

A medical DNA database is a DNA database of medically relevant genetic variations. It collects individual's DNA which can reflect their medical records and lifestyle details. Through recording DNA profiles, scientists may find out the interactions between the genetic environment and occurrence of certain diseases (such as cardiovascular disease or cancer), and thus finding some new drugs or effective treatments in controlling these diseases. It is often collaborated with the National Health Service.[4]

Among these three types of database we are going to use medical database and along with this the details about the individual's family members contact numbers is also added.

To store these data we need big data.

D. Big data

Big Data in healthcare is being used to predict epidemics, cure disease, improve quality of life and avoid preventable deaths. With the world's population increasing and everyone living longer, models of treatment delivery are rapidly changing, and many of the decisions behind those changes are being driven by data.

E. Storing in Big Data

Data volumes are growing very quickly. The methodology selected to store big data should reflect the application and its usage patterns.

Traditional data warehousing operations mined relatively homogenous data sets, often supported by fairly monolithic storage infrastructures in a way that today would be considered less than optimal in terms of the ability to add processing or storage capacity.[3]

By contrast, a contemporary web analytics workload demands low-latency access to very large numbers of small files, where scale-out storage - consisting of a number of compute/storage elements where capacity and performance can be added in relatively small increments - is more appropriate.

1) Scale-Out NAS:

This is file level access storage in which storage nodes can be daisy-chained together and storage capacity or processing power can be increased as nodes are added. Meanwhile, the presence of parallel file systems that scale to billions of files and petabytes of capacity allow for truly big data sets that can be linked together across locations and interrogated.

2) Object Storage:

This sees the replacement of the traditional tree-like file system with a flat data structure in which files are located by unique IDs, something like the DNS system on the internet. This potentially makes the handling of very large numbers of objects less taxing than is the case with a hierarchical structure.

3) Hyperscale:

Compute/storage architectures that have risen to prominence due to their usage by the likes of Facebook, Google etc. These see the use of many, many relatively simple, often commodity hardware-based nodes of compute with direct-attached storage (DAS) that are typically used to power big data analytics environments such as Hadoop. Unlike traditional enterprise compute and storage infrastructures hyperscale builds in redundancy at the level of the entire compute/DAS node. If a component suffers a breakdown the workload fails over to another node and the entire unit is replaced rather than just the component within.

Among this we use scale-out NAS as our system can support parallel file systems.

F. Security in Big Data

A major challenge to healthcare cloud is the security threats including tampering or leakage of sensitive patient's data on the cloud, loss of privacy of patient's information, and the unauthorized use of this information. Hence, a number of security requirements should be satisfied by healthcare cloud computing systems. The main security and privacy requirements for healthcare clouds are discussed below

- Authentication: in a healthcare system both healthcare information and identities of users should be verified at the entry of every access using user names and passwords assigned to users.
- Authorization: is an essential security requirement that is used to control access priorities, permissions and resource ownerships of the users on the cloud.
- Non-repudiation: implies that one party of a transaction cannot deny having received a transaction nor can the other party deny having sent a transaction. In a healthcare system, technologies such as digital signatures, timestamps, confirmation receipt, and encryption can be used to establish authenticity and non-repudiation for patients, CDOs, and practitioners.
- Integrity and Confidentiality: integrity means preserving the accuracy and consistency of data.
- Availability: For any healthcare system to serve its purpose, the information must be available when it is needed. High availability systems aim to remain available at all times, preventing service disruptions due to power outages, hardware failures, and system upgrades. Ensuring availability also involves preventing denial-of-service (DoS) attacks.

In our proposed framework we use authentication techniques such as One Time Password (OTP) [5] and Two Factor Authentication (2FA) [6] can be applied to protect EHR from tampering and unauthorized access.

IV. CONCLUSIONS

This paper proposes a framework for effective treatment of victims on road accidents using big data analytics. The framework provides a high level of integration, interoperability in accessing victim's family details and medical information with aadhar number. With this framework we cannot reduce accidents but can reduce death rate due to wrong treatment or death due to no treatment without knowing that person's medical history. In future this digitization of data can be adopted and applied in various fields to speed up data access and reduce paper work.

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